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Bolt and Nut Threading Machinery.

We show on this page two of the machines made for this work by Adams & Price Machinery Co., Chicago, Ill., and on page 2 some of the details of the machines.

These machines are designed to present the advantages of both open and solid die machines, being practically, when cutting, a solid die machine, with the advantage of releasing the bolt after it is threaded. This is brought about by the automatic split head used with these machines.

The dies are removable, easily adjusted; but when adjusted, are fixed and rigid. When the bolt is cut, the split head releases it and permits the escape of chips.

Every part of the machine can at any time be replaced with a duplicate piece.

An oil pump is used, which forces the oil into the head, thus thoroughly lubricating both bolt and dies.

Figs. 3, 4, and 5, page 2, show side, face and top views, with the head closed for cutting. Figs. 6, 7, and 8, same views, with head open and bolt released. The head proper is a steel forging, and the opening and closing bars, bar-locks, lock-pins, bushings and screws are hardened tool steel.

It will be seen that four dies are used, set diametrically opposite. These dies are clamped rigidly in place by face screws; to remove the dies it is only necessary to loosen these screws. Each die is separately adjustable by means of the adjusting-screw shown in Fig. 9. This is essential, because there is no certainty that the dies, however carefully made, will wear evenly. The accurate adjustment of the dies, when new, is made certain by a circle cut on the face of head and on the dies.

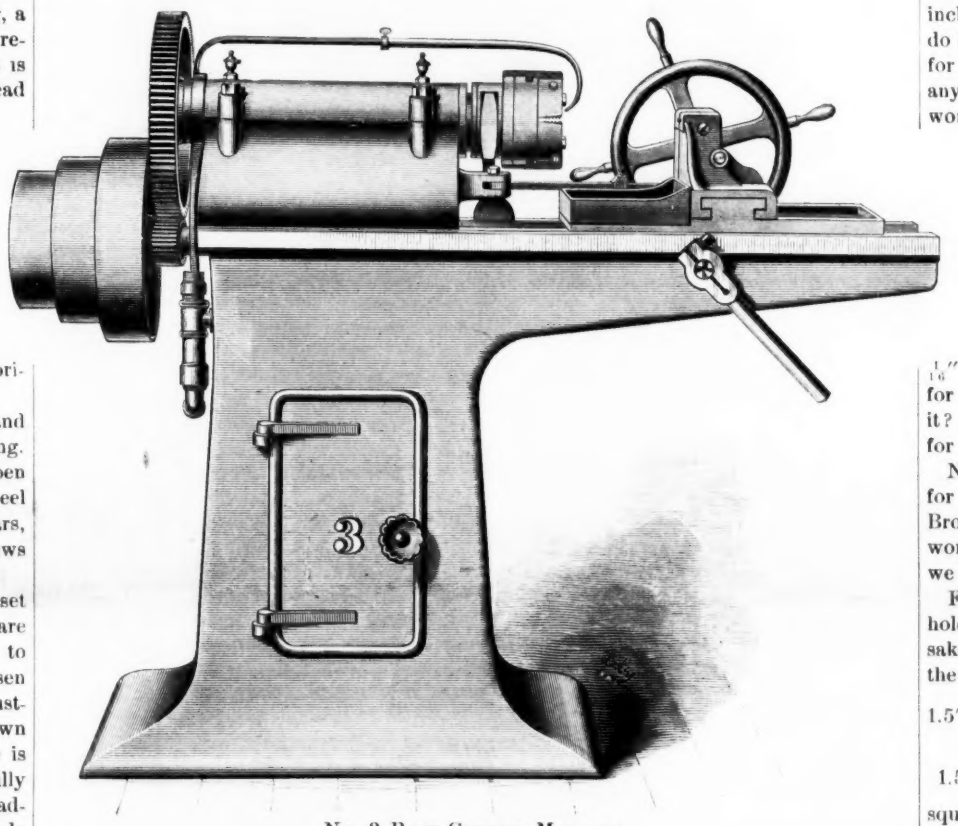
The automatic devices for opening and closing the head are shown in Fig. 10. One end of a horizontal lever, *O*, is pivoted to the front side of the solid shaft box of the machine, leaving the other end free. Through this lever a pivoted arm of a yoke, *P*, passes perpendicularly, the lower end of which rests in a small recess in the bottom of the oil well, or basin. The yoke works between the flanges of a loose brass collar, *Q*, held by the flanges, *M*, of, and moving on, the back plate of the head.

The free end of the lever, *O*, which has two lateral lugs, *K*, *K*, and a pin, *O'*, extending downward, engages itself on an adjustable lock, *T*, provided with a shoulder, attached to the side of the basin.

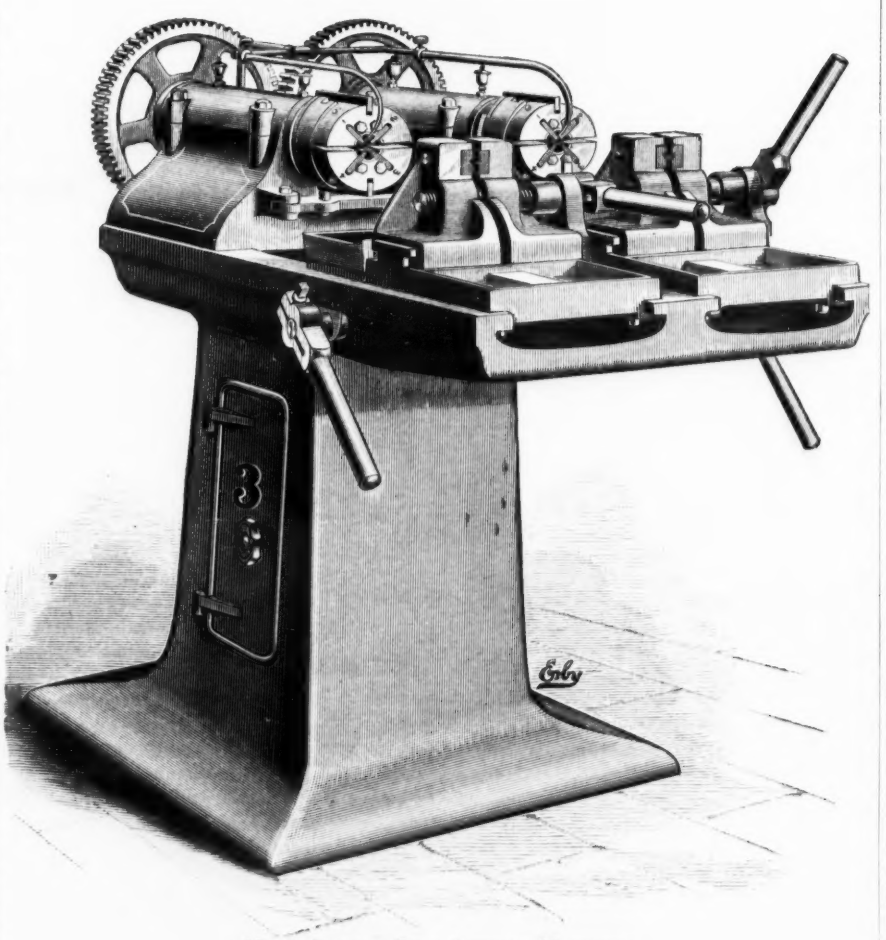
A rod, *R*, attached to the vise-carriage, and moving with it, passes through a guideway in the lock, *T*, directly under the lever, *O*. On this rod are placed front and rear inclined and adjustable collars, *S* and *S'*. As the carriage moves backward the rear collar, *S'*, engages the lever, *O*, with the lock *T*, closing the head. As the carriage moves forward, while cutting, the front collar, *S*, which can be adjusted for any length of thread, disengages the lever-pin, *O'*, from the lock *T*, and by means of a spring the lever is drawn back, opening the head instantly.

The oil pump is operated by an eccentric on a hollow shaft, and forces a steady stream of oil through a tube, passing over and pointing its nozzle into the die-head or carriers, and upon the dies and bolt, instead of merely dropping the oil on the bolt. The oil and chips fall into a removable perforated chip pan resting on the front end of the vise-carriage. The oil drops through it into the oil-well, or basin, and is used over again.

These machines are the invention of Mr. Adams, the president of the company.



No. 3 BOLT CUTTING MACHINE.



No. 3 DOUBLE BOLT CUTTING MACHINE.

Twist Drills and Twisted Arithmetic.

BY FRANK H. RICHARDS.

I suppose somebody has got to have the last word, and I am not at all anxious to achieve that feminine distinction; but really Brother Hobart is "too funny for anything." In the AMERICAN MACHINIST, June 27, he leads us through an arithmetical labyrinth, and emerges with the announcement that when cutting iron with a twist drill (I don't know whether it would work the same on brass with plenty of oil) you have to cut 123 + square inches $\frac{1}{64}''$ thick to get 1 cubic inch of iron. I knew the twist drill would do for Brother Hobart what it would not do for any one else, but I really did not expect any achievement so wonderful. But figures won't lie, you know. I am not sufficiently skilled in arithmetic to safely judge whether Brother Hobart is more expert or less expert with a lathe tool than with a twist drill, but he certainly gets a more diverse variety of results out of it. Cutting chips $\frac{1}{8}''$ thick on the lathe, he has to cut 10.66 square inches for each cubic inch of iron removed; but when cutting chips $\frac{1}{16}''$ thick, he has to cut 42.64 square inche for each cubic inch cut off. Funny, isn't it? He might get a new patent argument for coarse feeds out of it.

Now let us see if we can go over this thing for ourselves, and get as much out of it as Brother Hobart does. You can compare our work with his as we go along, and tell us if we make a mistake.

First, we take the twist drill cutting the hole $1\frac{1}{2}''$ diameter × 12″ deep, and for the sake of fair play we drop no decimals during the operation:

$$1.5'' \times 1.5'' \times .7854 \times 12'' =$$

21.2058 cubic inches of metal cut.

$$1.5'' \times 1.5'' \times .7854 \times 12 \times 64 = 1357.1712$$

square inches of surface cut with a feed of $\frac{1}{64}''$. Now, if we divide the surface cut by the number of cubic inches cut, it will give us the square inches of surface cut for each cubic inch removed, and we have

$$1357.1712 \div 21.2058 = 64 \text{ exactly.}$$

Quite a coincidence, certainly. In this operation we compute the cut of both lips of the drill. If we consider the cut of one lip only, it, of course, cuts but half the surface, and also removes but half the metal, and the result is the same.

Now, with the lathe tool turning 16.5″ diameter down to 15″ diameter, if we carry the cut 12″ we have $16.5 \times 16.5 \times .7854 - 15 \times 15 \times .7854 = 37.11015$, and then $37.11015 \times 12 = 445.3218$ cubic inches of metal removed. Then 37.11015, the surface cut at each revolution × 12″ × 8, if we have $\frac{1}{8}''$ feed, = 3562.5744 the whole surface cut, and 3562.5744 ÷ 445.3218 = 8 exactly. With $\frac{1}{16}''$ feed, of course the quotient would be 16, with $\frac{1}{64}''$ feed it would be 64, as we all know. Mr. Hobart must not be discouraged; he is not the first eminent mathematician who has failed to prove the self-evident.

It is proper to remind anyone who will do me the favor of going over this, that I am not just now engaged in discussion. The point which Mr. Hobart has been apparently trying to prop up with his twist drill is one entirely irrelevant to that upon which I first took issue with him. I think Mr. Hobart will scarcely reiterate to-day that the twist drill is the boss of all cutting tools. But we cannot let incorrect arithmetic pass unchallenged in the AMERICAN MACHINIST, you know. I have too much respect for arithmetic as one of the best tools of my trade, to

patiently see it placed at a disadvantage. I think the machinist is poorly equipped for work—every-day work—and little likely to progress much, who does not keep his arithmetic—I don't mean the book, of course—handy at all times and bright with constant use. It is the greatest of labor-saving devices, the finest instrument of precision, an unsparing critic, weighing the relative value of methods to improve them, a constant guard against ruinous mistakes, an essential element of all matters of record, the most potent weapon in all mechanical controversy.

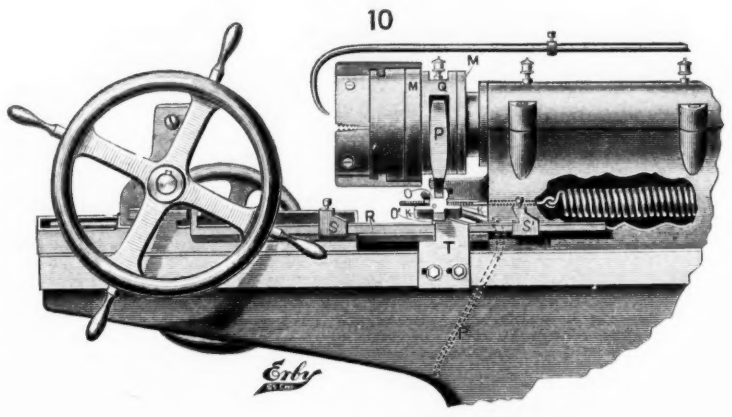
I agree with Brother Hobart in many things as heartily as I differ with him in others. I will kick as hard as he—in proportion to our relative size, a necessary mechanical reservation—against Sunday work. Nine-tenths of it is certainly unnecessary, and the arguments by which it is usually enforced are very apt to be insincere. Manufacturers develop an astonishing interest in the welfare of their operatives when their own pockets are likely to suffer from a little stoppage upon week days. I do not know any one who works for wages who is too wealthy, yet any one who would not be instinctively pleased by an unexpected chance to stop for a day or so for repairs would be a curiosity.

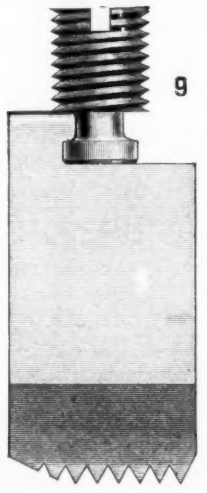
cess comes to him who applies the simplest means in the most direct way, and that, I suppose, is common sense. Well, if a fellow hasn't the common sense to know that lying and sneaking don't work, he hasn't the common sense to see in their best light the mechanical relations of things. He should get a position in a bank; he has no business in a machine shop. I have a great deal of pity for a poor fellow that gets into a scrape with a job, and will do all I can to help him out of it. Funeral sermons are the most unprofitable of all discourses. The right kind of a man will feel badly enough over a job without any of your irritating eloquence.

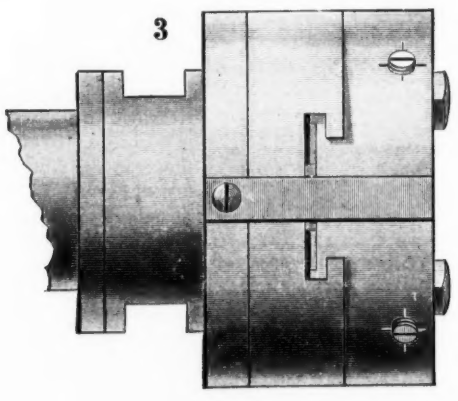
chain about every other day. I think I have sometimes had it break four or five times in a single day. The blacksmith used to keep a stock of links bent up ready to weld in. As soon as it broke I would be down on my back under the planer in about half a minute, and I became quite expert at repairing the old thing. One day young Ketchum sat on the floor in front of the planer scratching some castings, and I was in pursuit of the interesting at the other end of the shop. Suddenly there was a crash, and then young

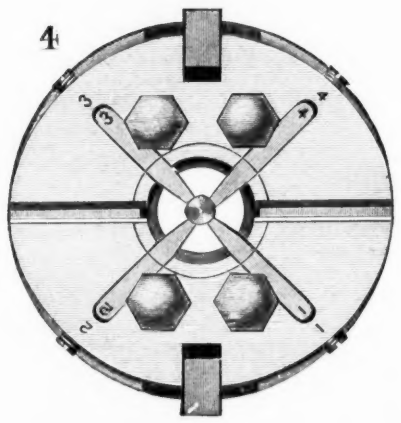
ran into the shop, the tool, cutting towards the cylinder, of course, had got to the cylinder, and had got into the cylinder, and had almost got through the cylinder, and the confounded chain had no thought of breaking. Nobody scolded me. It wouldn't have done any good. They put the cylinder gently on its bed, and it went out into the world, and, so far as I know, lived its life of usefulness and activity unharmed; but the thought of it troubled me by day, and visions of it haunted my dreams in the silent watches of the night for a long time.

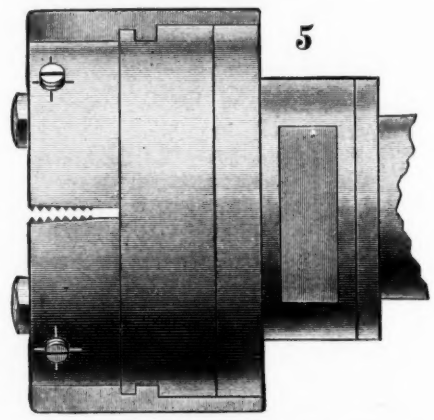
An encouraging word will help a fellow along wonderfully once in a while. I used to get such words about the time I am thinking of. Let's see. I was fifteen, and I used to plane at that time some cast-iron tracks or slides for saw-mills, of which we made a great many. They were about eight feet long, pretty heavy to handle, and requiring some skill to pein (I don't know how to spell that) them straight. It used to be Dave's job, and Dave was the head man of the shop. Well, the proprietor remarked to me, by way of encouragement, that he didn't see why I couldn't plane the slides quite as fast as Dave planed them. That kind of thing helped me along wonderfully. Then he paid me fifty dollars for m.

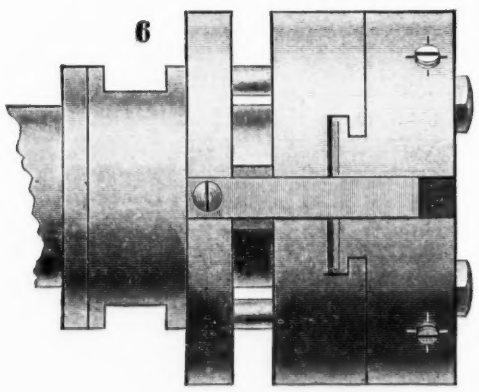


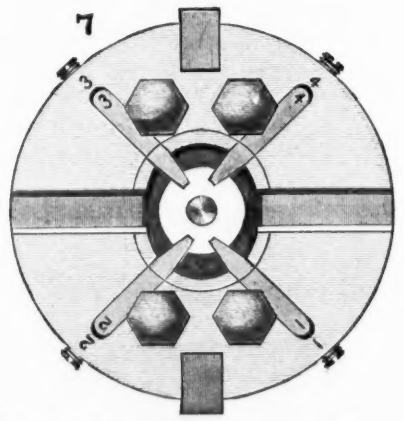


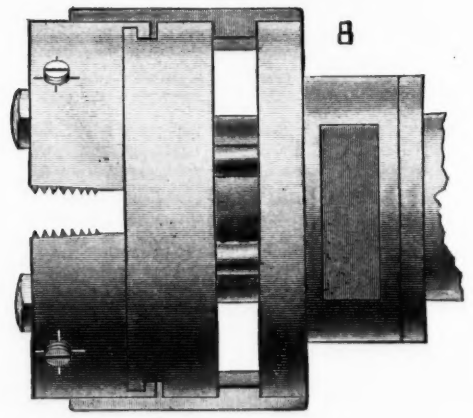












DETAILS OF BOLT CUTTER.—*See page* 1.

Then in his last, Mr. Hobart speaks of the dishonest concealment of errors of workmanship. It is the most detestable and unpardonable of faults, and I am happy to say it is a very rare one in my latitude. Of course, the manner in which bosses take such things will make a great difference in the result. One cannot be too vigilant beforehand in foreseeing and preventing possible mistakes, and in guarding against carelessness and its consequences; but he can be very much too severe in his denunciations of such things after their occurrence, and so promote the habit of concealment. If you can't be honest yourself, and squarely shoulder your own blunders, if you happen to be human, you can't expect and you don't deserve to find honesty anywhere around you.

Yet there are plenty of good mechanics that it would take a pretty bad boss to demoralize into any serious act of dishonesty. A good mechanic is of necessity honest, independently of all his surroundings. The machinist trade is, of all others, the trade that calls for common sense. The greatest suc-

Don't care, is not the worst or most frequent fault of the machinist.

Talking in this strain sends my thoughts backward over one or two of my earlier experiences. Something over thirty years ago I was at college at Plattsburgh, N. Y. The institution I attended had a water-wheel below and a big bell on the top. Gen. Banks used to put it that way. I didn't know it then, but am quite well convinced now, that I had a pretty good time in those days. I certainly learned a great deal in that old shop, although at the time I thought I knew it all. We had quite a free-and-easy time, but we turned out lots of good work all the same. I have caught any quantity of fish out of the northwest corner window there. One season we had a run of young pickerel about as long as your finger, the prettiest little fellows I ever saw in my life.

I was mostly running a planer at that time. It was a chain planer, about 30″×30″ ×10′. It had long ago seen its best days, and they couldn't have been very good. I had a perpetual and everlasting circus with that planer. Used to break a link of the

Ketchum began to squeal, and everybody ran to see what was the matter. The chain had broken and the platen had run off. Ketchum was not very badly hurt. A horn that stuck out about a foot at the front end of the platen to carry the dog, had dug into the floor and stopped it from falling clear off, or the boy would have been smashed as flat as a dollar bill. I was so badly scared that I looked like a white pig tied to a gate-post, as some one kindly remarked.

At another time—it was in the spring—I had on a cylinder, 18″×48″, one of the old-fashioned fellows, planing the feet. "We never won't see no more such cylinders as them air." It took about three-quarters of an hour to run a cut over one of those feet, and it was no object to me, you know, to stick right alongside the old planer all that while. The bay was brimful of perch and alive with boats, and the boys were hauling in the fish about as fast as they could handle the lines, and I strolled down to the point of the island to see the fun. I saw the fun, and I kept on seeing the fun, and, when I came to my senses and thought of the cylinder and

first two years' work, and once, when he was feeling very good, he gave me one peanut. Every one can't expect to begin the trade under such favorable auspices.

I acknowledge, with pleasure, a photograph of "the scratched post." It is one of the greatest of mechanical curiosities, and, as such, I will cherish it. The exclamations of horror among the mechanics to whom I exhibited it were thrilling and forcible. No one could gaze upon the picture unmoved. I hope the AMERICAN MACHINIST will be able to reproduce it as a warning to the mechanical community, although it was evidently taken under very unfavorable conditions. For the purpose for which it was taken, it would be more complete and satisfactory if Tom, the terrible, talkative, typical tool tantalizer, stood beside it with a bushel basket full of feather edges at his feet, and his boot legs decorated with chalky hieroglyphics, according to his wont. I can never be too thankful for the discretion which deterred me from ever doubting the existence of the intensely abraded post. I still privately think that it was done in scratching the mud off, instead of feather edges. I am told iron is better to remove the latter.

Modern Locomotive Construction.

BY J. G. A. MEYER.

FOURTH PAPER.

TRACTIVE POWER.

We now come to the consideration of the size of cylinders necessary to turn the driving wheels. Neglecting the friction of the machinery, we may say that the cylinders with a given steam pressure must be large enough to almost slip the wheels; that is, to turn the wheels without advancing on the rails, when the engine is attached to the heaviest train that it was designed to haul. Or, in other words, if a certain amount of weight is placed on the drivers to haul a given train, we must design our cylinders so that a sufficient power can be obtained to turn the wheels, and not more and not less, when the engine is attached to this train. This power which is necessary to turn the driving wheels under the above conditions is called the "tractive power" of a locomotive. If the cylinders are too small in proportion to the weight placed on the drivers, then the engine cannot haul the train that it was intended it should do with this correct weight on the drivers. If, on the other hand, the cylinders are too large in proportion to the weight placed on the drivers, then the engine cannot employ all its tractive power. In either case, there will be a waste of material and steam. Here, then, we see that in a correctly-designed engine there is a fixed relation or proportion between its tractive power and the weight placed upon the drivers. The tractive power is not only dependent upon the diameter of the cylinders, but also depends upon the diameters of the drivers, the length of stroke, and the mean effective steam pressure per square inch of piston.

Before the tractive power of an engine can be calculated, we must know how much of a resisting force is to be overcome. In Fig. 8 we have represented a pair of cylinders and *one* of the front pair of driving wheels of an eight-wheeled engine, such as shown in Fig. 1. One of the cylinders in Fig. 8 is connected to the driving wheel; the other cylinder is connected to a crank fastened to the same axle, and not connected to a driving weeel, because we have assumed that there is only one driving wheel on the axle. Let us also assume that the cylinders in Fig. 8, with frames, valve gear and all necessary mechanism, are firmly fastened to blocks or a foundation, so that this figure represents a complete stationary engine. The driving wheel is not to touch the track, but the whole engine is set high enough so that a rope can be fastened to the lower part of the driving wheel, in such a manner that when the other end of the rope is attached to a train this rope will be parallel to the track, as shown. When this engine is set in motion in a direction as shown by the arrow, it will haul the train towards the engine. Now, the power that this engine exerts in doing this is precisely the same as the tractive power of a locomotive designed to do the same amount of work. Should the total weight of this train be 1,000 tons, then, according to what has been said before, it will take 7,500 pounds to move it, and, therefore, the stress, or the pull on the rope, will be 7,500 pounds.

If, instead of fastening this rope to the train, we pass it over a pulley *a*, and attach a weight *W* to it, weighing 7,500 pounds, and, as shown on the dotted lines on Fig. 8, then the stress or the pull on the rope will not be changed, but still remain as before, namely, 7,500 pounds, and therefore we conclude that the power necessary to move the train is exactly the same as the power necessary to hoist a given weight.

For the sake of clearness and simplicity, when calculating the tractive power of a locomotive, we shall hereafter always assume that the train resistance is represented by a weight *W*, fastened by the means of a rope to *one* driving wheel, as shown in Fig. 8, and that the cylinders must be made large enough to be capable of lifting this weight.

But the reader may say that a locomotive has more work to do than the stationary engine here represented, because the locomotive must move its own weight, which the stationary engine has not to do. This is true, but it must be remembered that we are allowing 7½ pounds for every ton of the weight of train that is to be moved, and, as we have stated before, this may be considered—and we do consider it so—as not only sufficient to move the train, but also sufficient to move the weight of the locomotive and overcome the friction of its mechanism. Yet we must again call the attention of the reader to the fact, that any particular or given speed is not yet taken into consideration; we are simply proportioning an engine capable of moving a train very slowly.

The foregoing being thoroughly understood, the solution of the following example will not seem so difficult:

EXAMPLE 4.—Find the diameters of the cylinders for an eight-wheeled locomotive, whose total weight on drivers is 20,000 pounds, the diameter of the driving wheels is 45 inches, the stroke 20 inches, and the mean effective steam pressure 90 pounds per square inch of piston area. (The writer believes that for the mean effective steam pressure 90 pounds per square inch is a good average, and this will always be adopted unless otherwise stated.)

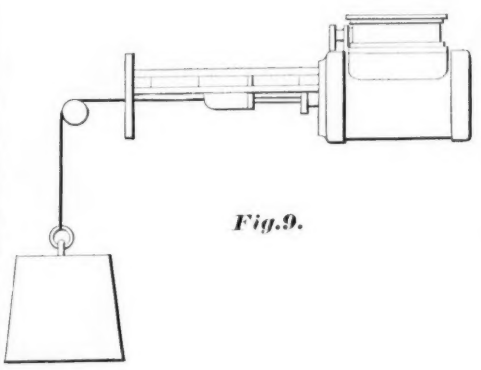


Fig. 9.

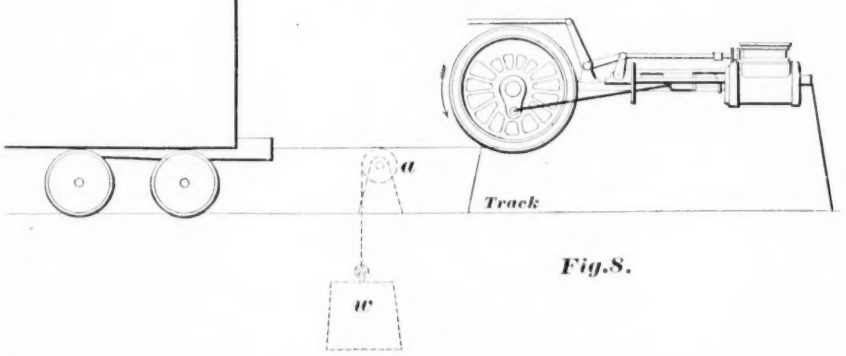


Fig. 8.

From what has been said before, we know that the total adhesive force will be one-fifth of the weight placed on the drivers; hence the total adhesive force will be one-fifth of 20,000, which is equal to 4,000 pounds. We have also seen that the adhesion is equal to the train resistance; hence the weight *W*, in Fig. 8, which represents the train resistance, must weigh 4,000 pounds. Now, all we have to do is to find the diameters of the two cylinders, as shown in Fig. 8, capable of lifting this weight of 4,000 pounds; and so for all locomotives, when the total weight on the drivers is known, no matter how many driving wheels are to be placed under an engine, we always assume that the train resistance is represented by the weight *W;* that all this weight, or train resistance, is applied to only one driving wheel; and that the two cylinders must be made large enough, so that their combined effort will be capable of lifting this one weight *W*, which in all cases will be one-fifth of the total weight placed on all the drivers, because we have assumed that the adhesion is one-fifth of the total weight placed on the driving wheels.

In our example, as we have already seen, this weight *W* is equal to 4,000 pounds, and the diameters of the driving wheels 45 inches each. When the wheel has made one revolution, the weight *W* will then have been raised through a distance equal to the circumference of the wheel, and this circumference is 141.37 inches, or 11.781 feet.

In raising this weight, a certain amount of energy must be expended; and, to know exactly how much has been expended, we must compare it to some standard or unit of energy.

The small exertion that is required to raise or lift one pound one foot high is called the unit of energy or foot-pound; hence, if two pounds are lifted one foot high, two units of energy have been expended, or, if five pounds are lifted one foot high, five units of energy have been expended; and, if the five pounds are raised five feet high, then 25 units of energy have been expended, because, to raise the five pounds through the first foot, five units of energy will be required; to raise them through the second foot another five units will be required; the same for the third, and so on up to the fifth, making a total of 25 units of energy, or foot-pounds.

In our example a weight of 4 000 pounds must be raised 11.781 feet high. To raise this weight through the first foot, 4,000 units of energy or foot-pounds will be required; and the same amount of energy will be required to raise it through the second foot, and again the same through the third foot, and so on until the height of 11.781 feet has been reached; therefore, the total number of units of energy, or foot-pounds, that must be expended to raise this weight through a distance of 11.781 feet is $4{,}000 \times 11.781 = 47{,}124$ foot-pounds. And so for all engines we multiply the weight, *W*, in pounds, which represents the adhesion, by the circumference of the wheel in feet, and the product will be the number of foot-pounds or units of energy that must be expended during the time the wheel makes one revolution.

But the energy necessary to raise this weight is derived from the steam pressure in the cylinder, and since the mean effective steam pressure per square inch of piston is already given—namely, 90 pounds—it only remains to make the cylinder of such a diameter that we can obtain 47,124 units of energy for every turn of the wheel with a weight attached, as shown in Fig. 8.

But now notice the fact that during the time the wheel makes one turn, raising the weight 11.781 feet high, the piston travels through a distance equal to twice the length of the stroke; the stroke being 20 inches, the piston travels through a distance of 40 inches, or 3 33 feet. During the time that the piston travels through a distance of 3.33 feet, 47,124 units of energy or foot-pounds must be expended, and therefore, dividing 47,124 by 3.33 feet, we have $\frac{47{,}124}{3.33} = 14{,}151$ foot-pounds. This last answer simply means that in order to raise the 4,000 pounds weight through a distance of 11.781 feet, the weight being attached to the wheel, as shown, will require as many units of energy as to raise a weight of 14,151 pounds 3 33 feet high, the weight being attached directly to the end of the piston rod, as shown in Fig. 9.

Now, it must be readily understood that the mean effective steam pressure on each square inch of piston will lift a portion of this weight of 14,151 pounds, and the amount that the pressure per square inch of piston will lift is 90 pounds, hence, dividing 14,151 pounds by 90 pounds, we have $\frac{14{,}151}{90} = 157.2$ square inches. This means that the total piston area must be 157.2 square inches. But we have two cylinders; therefore $\frac{157.2}{2} =$ 78 6 square inches in the area of one piston; and a piston having an area of 78.6 square inches, must be 10 inches diameter. Hence a locomotive having four driving wheels, with 20,000 pounds placed upon them, the driving wheels being 45 inches in diameter, and a mean effective steam pressure of 90 pounds per square inch, will require cylinders 10 inches in diameter and 20 inches stroke.

Here we have calculated the diameters of the cylinders suitable for a given weight placed on the drivers. We may reverse the order of this calculation, and find the necessary weight that must be placed on the drivers, when the dimensions of cylinders and diameters of driving wheels are given.

EXAMPLE 5.—The diameter of each cylinder is 10 inches; stroke, 20 inches; diameter of driving wheels, 45 inches; mean effective steam pressure, 90 pounds per square inch of piston. What is the tractive power of such an engine? And how much weight must be placed on the drivers?

The area of a piston 10 inches in diameter is 78.54 square inches. Multiplying the area of the piston by the steam pressure per square inch, we have $78.54 \times 90 = 7058.6$ pounds total steam pressure on one piston; but there are two pistons, hence $7068.6 \times 2 = 14137.2$ pounds, which is the total steam pressure on both pistons. The stroke is 20 inches, and during the time that the wheel makes one turn, the piston has traveled through twice the length of the stroke, hence $20 \times 2 = 40$ inches, or 3.33 feet, which is the distance through which the piston has traveled during one revolution of the wheel. Multiplying the total steam pressure on the pistons by 3.33 feet, we have $14137.2 \times 3.33 =$ 47076.876 foot-pounds, or units of energy the cylinders can exert during one revolution of the wheel. The driving wheels are 45 inches in diameter, hence the circumference of each wheel will be 141.37 inches, or 11.78 feet.

Ex-Commander Henry R. Gorringe.

Henry R. Gorringe, who recently died in this city was forty-four years of age. Early in the war of the rebellion he enlisted in the Navy, where, by his gallantry and ability, he gained rapid promotion, being at the close of the war Acting Volunteer Lieutenant-Commander. In 1868 he was commissioned as Lieutenant-Commander, which position he resigned a few years since.

Commander Gorringe is best known in connection with transporting the Egyptian Obelisk, and erecting it in Central Park, an undertaking which he carried out so successfully as to elicit much favorable comment. Lately he has been engaged in an enterprise for constructing iron vessels in this country.

Commander Gorringe was a man of marked ability, and varied accomplishments.

A railway is proposed in Louisiana to run "to a point just below Hard Times." There are hundreds of other railway projects aiming to get past "Hard Times"—a very unpopular place. They are all pointed toward "Good Times Coming," and will get there if they can wait long enough.—*Railway Age.*

There has recently been completed at the Cornell University, for use there, what is said to be the largest galvanometer in the world. It will doubtless be of great value to the electrical engineering department of the University.

Rev. Dr. Talmage says "people can't go to heaven by steam." He has never witnessed the effects of low water and a hot crown-sheet.

The "Mogul" Stationary Engine.

The general design of this engine is very clearly shown in the engravings, pages 4 and 5. The frame is of the horizontal girder type, modified so as to secure a long bearing on the foundation. The bottom of the bed is in the form of a trough, which serves to collect all drip, and to stiffen the frame.

The ports extend to the bottom of the bore of the cylinder, so as to drain all water of condensation from the cylinder.

Rods and pins are of steel; crank counterbalanced.

The cylinder is jacketed to reduce the loss from radiation.

In sizes these engines range from 7″×12″. rated at 10 horse-power, to 18″×24″, rated at 100 horse-power.

They are made by Merwin McKaig, Cumberland, Md.

Hints on Nickel Plating.

(From *The Jewelers' Journal.*)

In order to prepare articles for a coating of nickel, it is necessary that they be well cleaned, to remove any grease or oleaginous matter in which they may have come in contact. To level or smooth the surface of the article, the emery wheel is generally first used, and this is followed by the buffing wheel, which gives a finely polished surface. A rag wheel, made of disks of common cloth put upon a mandril, and held by flanges, rouge being applied to the cloth, is the general means for giving the final polish, for the higher the polish the more satisfactory will be the result after the nickel is upon the surface.

The cleaning follows the final polishing, and to remove all traces of grease, etc., a bath of benzine, lye, or soda is generally employed. Sometimes a thick mixture of powdered chalk or whiting mixed with a little aqua ammonia is used, the work being held with wooden clamps while being brushed with the mixture, so that any contact with the fingers is avoided. The articles are then washed in clean running water, and as a test of the requisite cleanness, when lifted from the water the aqueous film will appear evenly on all parts of the surface. The work is then ready to be placed in the bath, which should be done as soon as possible. If great care be not taken to remove all traces of grease, oil, dust, or dirt, the result will be unsatisfactory.

The bath in which the work is to be placed can be composed of sulphate of nickel and ammonia, with pure rain or distilled water—about ten ounces of the salt to each gallon of water. This bath should be so covered as to protect it from dust and impurities that may impair its qualities. The tank or vessel in which the bath is contained may be made of wood, and coated on the inside with melted asphaltum or asphaltum varnish. For small baths a porcelain-lined iron tank of suitable dimensions or a common stone jar may be used.

The work may be suspended from copper wires or rods, which are laid across the top of the tank, connecting links or hooks being used to connect the work with the rods. A wire from the zinc of the battery is connected to these rods, while another wire is connected to the nickel anode or feeding plate. The anodes may be suspended around the sides of the tank or facing the work, care being taken that they be not too near the articles. They may be suspended by rods or copper hooks, but these hooks should not be permitted to touch the liquid.

The length of time that the work should remain in the bath depends on the thickness of plate wanted and the strength of the battery. A weak battery in long exposure gives the best results. If the battery be too strong, the work will present a gray, rough or dark appearance. If too weak, it may present an imperfect granular appearance. When the work is first put in the bath it should be moved about, so as to free it from any air bubbles that may adhere to it.

The amount of battery power for a given amount of work should be in the zinc-exposed surface about equal to the surface of the work exposed in the plating bath.

The surface of the nickel anode should be no less than the surface to be coated. It may be much greater than the surface to be coated and more and better work will be the result.

In large establishments the dynamo-electric machine is almost exclusively used for plating, but in a small way the small battery is generally employed. This battery is well known, and has the merit of being cheap and easily managed. Almost any work of natural philosophy will give its construction and management.

On removal of the plated work from the bath, it should be rinsed in cold water and then transferred to hot water, which will cause it when taken out to dry quickly and perfectly.

It may be necessary to cover articles of iron or steel with a thin coat of copper to make the nickel adhere. This may be done by a cyanide bath, which is prepared by dissolving precipitated oxide of copper in cyanide of potassium, using a copper plate as an anode. After removing from the copper bath, wash quickly with water and place in the nickel bath. If the coppered surface be allowed to dry or tarnish the nickel will not adhere.

There is a method of plating with nickel without the use of a battery; it is briefly this: In a copper or porcelain plating vessel put a concentrated solution of zinc chloride, dilute it with from one to two volumes of water and heat to boiling. If any precipitate separates re-dissolve it by adding a few drops of hydrochloric acid. A few grains of powdered zinc are thrown in and the internal surface of the vessel is covered with a coating of zinc. The nickel salt is then added until the liquid is distinctly green. The articles to be plated, being thoroughly cleaned, are introduced, together with some fragments of zinc. The boiling is kept up for about fifteen minutes, when the process is finished. If a thicker coating be desired repeat the operation.

Cutting Tools.

BY S. W. GOODYEAR.

I have been reading up about cutting angles, and clearance angles, and necessity for thread tools leaning in one direction for cutting right-hand threads, and in the opposite direction for left-hand threads. I must confess that I forge and grind all sorts of lathe and planer tools and don't know enough about the proper angle by actual test to venture an opinion as to *just* what it should be. But I am clear on one point, the clearance angle must be sufficient to not permit the tool to ride, even after the first edge is worn off a little. And I am *just* as sure of another thing, the smallest amount of clearance, which insures this is, for most tools, the best.

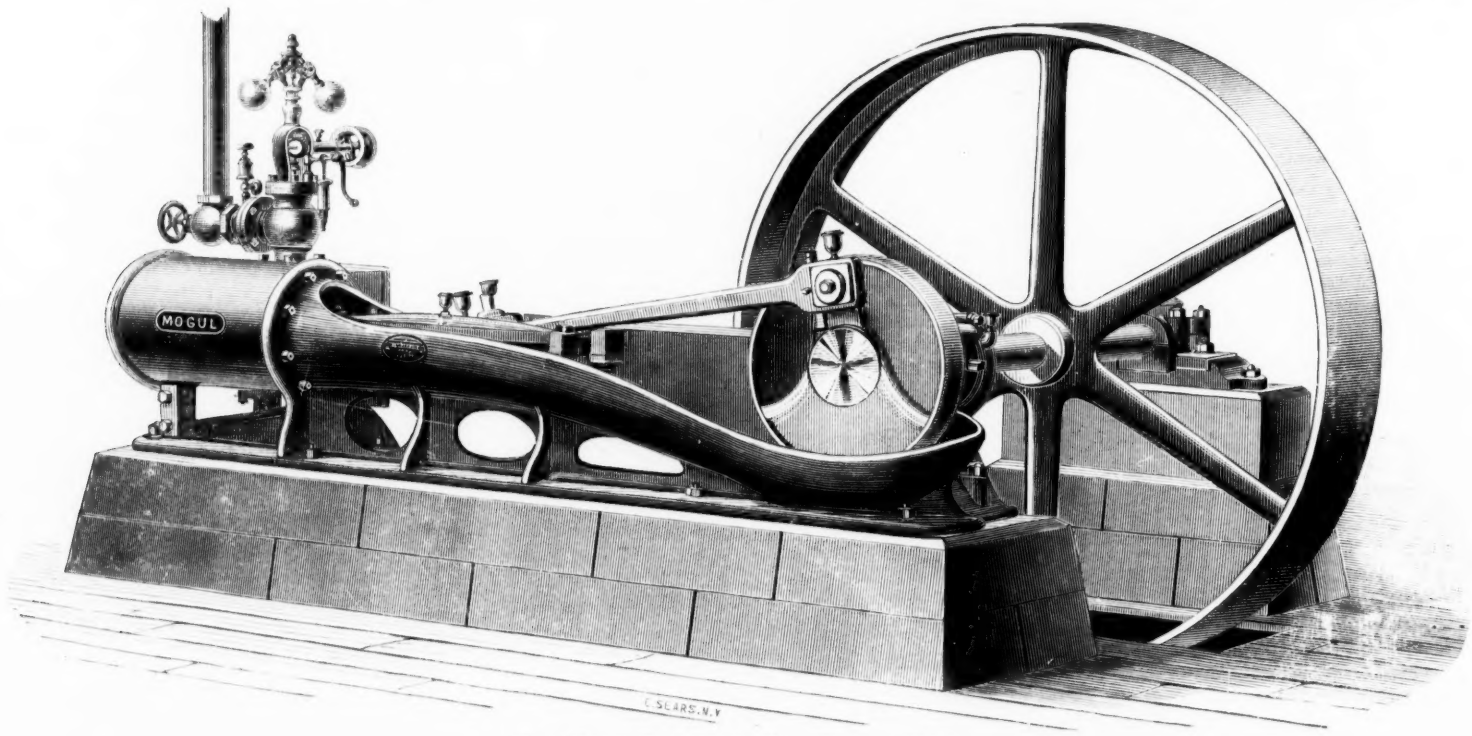
Suppose we could have a full set of lathe tools with the angles at top and underside just right. (No matter what just right is, for, as it is a well known fact that opinions vary on the subject, it will be as well to give no figures). With but one man to use this set of tools, and he restricted to using the one set only, his work should require him to use the tools alternately on several different lathes made by different machine builders. That the diamond point tools have been pronounced just right by the stickler for exact angles of clearance and cut, will be of little avail, when it is found that on one lathe it is impossible to get the point low enough to clear at all, except by blocking up the back end of the body of the tool until, instead of the horizontal position which it should occupy, it assumes an inclination which even the small boy with any hand-sled experience knows at a glance is a long way from level.

How does a tool cut, set in this way? You never tried it! Well, you should be thankful. What am I driving at? This: The relation between the bearing fixed for tools in tool-posts—as different makers fix it—and the axis of the spindle varies so much that a tool which is just right for one lathe can only be used at a disadvantage, or, perhaps not at all, on a lathe of the same swing built by another maker, and, that while it is probable that there is a right shape for tools, it is necessary to know what are the facilities for setting them, in order to determine what right is, for the particular lathe in which they are to be used.

Rigidity of adjustment; as short a section of the body of the tool projecting beyond the tool-post as convenient; suitable *real* angles for cut and clearance; these conditions should be sought in the interest of prevention of spring, and chatter, rather than to spend time in figuring out the exact shape of "camel back," which, if it springs, will spring out of the work, instead of springing in deeper to catch, (this is the theory, is it not?) and which after all needs to be set more exactly in keeping with its shape than most other tools, or it will aggravate the difficulty which it is expected to cure. In this matter of suitable clearance and best cutting angles, it will not do to depend upon the shape of tool too rigidly. Shape of tool, character of tool-post, but, more than all else, the good judgment of the latheman in setting the tool, come in to make up the *real* angles of cut, and clearance, in many well working tools, which, if considered by themselves would be called faulty in shape. On the other hand; tools of the most perfect shape may be bunglingly set, or, may be used in lathes where it is impossible to set them properly. Brain; good reasoning faculty on the part of the man who uses the tools; ability to distinguish between *real* angles of cut and clearance as tools *must* be set, and *apparent* angles as shown by the tools themselves, these will continue in the future, as in the past, to stand in the way of any man, who, with protractor in hand, tries to tell the machinist in figures the suitable angle for lathe tools.

Some of the closest workmen at the lathe have never tried to determine what was right by any test or formula, but give them any tool with the statement that it was just the right shape for that kind of tool, and they will say: "Depends on what lathe it is to used in; on what size of work; on what material; in what condition the material is; of what quality of steel the tool is made; how it was hardened; whether it is thoroughly hard, and still has tenacity to carry a fine edge; or, whether it is in condition to crumble unless the edge is thick."

We fellows who run lathes on promiscuous work have a good many things to think of. Look at these two diamond-point tools. One has a long blade standing out of a vertical position when the body of the tool rests horizontally in the tool-stock at least thirty degrees, and may be, if we try the protractor on it, we shall find it nearer forty-five degrees than anything else. The blade on the other stands exactly vertical, or at an angle of ninety degrees from the body of the



THE MOGUL STATIONARY ENGINE—SIDE VIEW.

tool. They are both good tools. The first must be set 'way above the center, and the other must be set clear down to the center. If we set this last one above the center in the least degree, it will not clear. Is we set this long-nosed tool, with its nose sticking 'way out down at the center, it won't cut, it will tear, and chatter; but when we get it 'way up above the center, where there is just about clearance enough so that the blade goes clear of the work, and the top of the tool comes in contact with the chip which it is to remove, at a cutting angle, instead of scraping, why, then, its all right. There must be a little lee-way. You must have a chance to raise and lower.

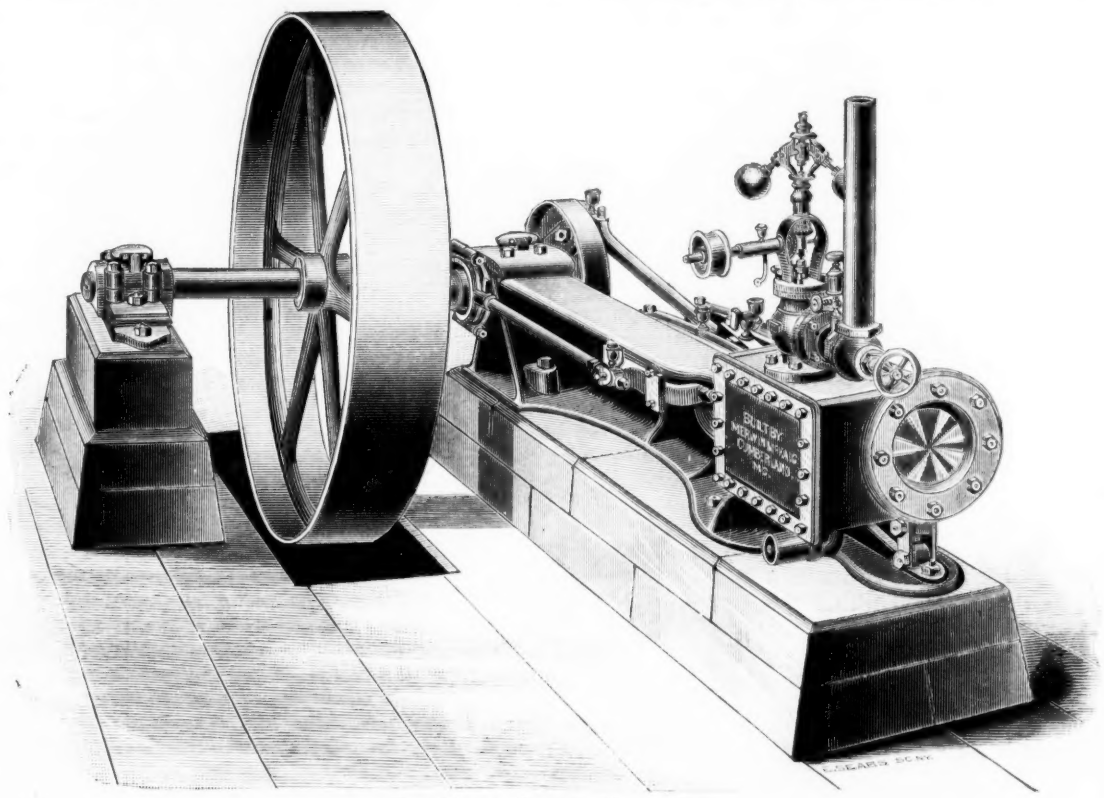
We used to forge our own tools, and then, knowing what lathe we were to use them in, we could guess mighty close to the shape; but now, since the advent of tool-dressers, who do that work for the whole shop, and tool rooms, out of which the tools are dealt to all hands, it is different. Tool-posts which raise and lower, and can be made firm in any position, and give a good solid bearing exactly level, for the tool to rest on, are pretty good things. Just think of the bother we used to have, blocking up with bits of iron and steel, and nuts, and washers, and cut nails, and how we used to let slip now and then a cuss word when some pet blocking piece was borrowed by a shopmate who forgot to return it. No matter if it was only a cut-nail, there could not be another found in a whole keg to fill its place. And so we would hunt for it, and mourn, and profane. We don't do so, so much, now. It's a bad habit to swear, and the less loose traps you have for the other fellows to bor—— steal, the less danger there is of swearing.

What did you say about clearance on a thread tool? If a thread tool has about the right amount of clearance, and is set where it must be to cut a perfect thread, that is, at the center, the lower half of the circle of that which is being threaded falls away so fast, that for us plain, practical men in cutting V-threads, we often use the same tool with which to cut both right and left-hand threads. Of course there must be clearance enough on both sides of the tool, but, unless we have very coarse threads to cut, when there is clearance enough on the leaning-away side of the thread, there is not enough too much on the overhanging side to do any particular harm. Anyhow, we cut pretty good threads with tools which we grind by eye, except so far as the use of the thread-tool gauge is concerned, to get the proper shape of thread.

About this matter of clearance, and how to set tools, you would be surprised to see the variety of ways in which the same tools have to be set on account of differences in size of work, stock, condition of stock, etc. Did you ever see anybody set a tool bottom side up, and turn out a hole by working at the back side? What excuse could there be for doing so awkward a thing? Well, I don't mind telling you. With the hole to turn in a piece, which, bolted to the face-plate of the lathe, left the face of the piece where the hole was to be turned out nearly two feet from the face-plate, the weight of the piece overbalancing the weight of the spindle of the lathe, so that, whatever there was of play in the back bearing, or spring in spindle or face-plate, developed into a hanging down of the front of the piece, there was a tendency under the strain of cutting the lightest chip even, with a tool set in the ordinary way for the front of the piece to lift up, and set up the worst chattering imaginable. This was cutting against the weight of the piece as the resisting force. By turning the tool over and working on the back of the hole, cutting from the upward motion of surface, the hanging down of the weight already forcing the back journal to a solid bearing, the strain of cutting only tended to make the resistance more rigid. Of course this sort of turning requires that the carriage be gibbed down snugly, and, it is not best, perhaps, for all the boys to try it for a regular thing, but, as an illustration of why some tools chatter, and how to stop them, this may set some of them thinking how to set tools *right side up, just right.*

Did you ever notice what a passion some men have for setting all turning tools 'way up above the center? And, do you know that some of them don't seem to have learned that there is any difference between setting a tool above the center for turning down a shaft, and turning out the hole in a pulley to fit the shaft; when the fact is, that the effect of carrying a tool below the center in turning out a hole, is precisely the same as that of setting above the center in outside turning, and with tools of excessive clearance, with points well out, there is no way to strike a good cutting angle for the point of the tool, as considered in combination with the periphery of outside turning except to set high, and equally necessary is it in the case of inside turning to set low, when such tools must be used.

Who has not seen, sometime, an inside turning tool which was a diamond-point setting; at right angles with the body of the tool, the point being so long, and setting so high, that to permit the body of the tool to clear, the point must be set above the center? How a such a tool will chatter and tear!



THE MOGUL ENGINE—REAR VIEW.

The Peerless Emery Wheel Dresser.

The form and construction of this tool are shown in the engraving. The head contains a solid steel cutting cylinder, which forms a combination of cutting edges; these are tempered so as to give them great strength and hardness. The shield over the cutter guards the eyes of the operator while using the tool.

In using this tool the wheel is run at ordinary working speed, with the rest about level with the center of the wheel. This will true up the wheel without breaking pieces from it.

If the wheel is only glazed, it is not necessary to use the rest; holding the tool on the top of the wheel will accomplish the desired end.

S. A. Smith, 59 South Canal street, Chicago, Ill., is the manufacturer's agent for the sale of these tools.

Casting Steel in an Ordinary Cupola and Publishing the Process.

BY ROBERT E. MASTERS.

The AMERICAN MACHINIST, July 5th, 1884, contains the following inquiry in connection with an article on "Blacking Loam Moulds" from the writer:

I want to ask the readers of the AMERICAN MACHINIST if they know anything about melting steel in a common foundry cupola. I mean steel alone. I understand the steel mixture. This firm uses about one thousand tons of steel a year in the manufacture of steel plows, and have tons of steel scrap on hand, which is a dead loss down here. If I do not get any information, I am going to try a small heat, and I'll let the result be known through this journal.

This was the beginning of the discussion on steel melting, and as I did not succeed in obtaining the desired information, I began to experiment for myself. The AMERICAN MACHINIST of August 23d, 1884, and April 25th, 1885, published the results, which, together with an editorial on this subject in issue of May 16th, 1885, have been copied by the mechanical journals in this country and Europe.

Letters of inquiry from firms all over this country, together with a number from the British provinces and England, arrived in every mail asking for complete detail. Several of them contained checks for a reasonable figure as a compensation for the information they asked for, but a large majority wrote that they "would appreciate the information," and did not even enclose a stamp for an answer. Let me illustrate: In one day I received letters from twenty-four firms. One of them contained a check for fifty dollars, one contained a stamped envelope, and two contained postage stamps; the other twenty "would appreciate the information."

I am willing at all times to give all the information I am able to on this or any subject pertaining to foundry practice, through the medium of the AMERICAN MACHINIST, and upon whatever subject I may write, if there is any individual or firm who fails to understand it, or desires more information on the subject, and will make their wants known through this journal, I will be glad to answer to the best of my ability through the same medium, so that it will benefit more than one. I do not speak complainingly, and my reason for writing this is I dislike to let a letter go unanswered. I have a large number on hand now which I will answer in a general way on all points about melting steel, preparing the moulds, etc., etc., in an early issue of the AMERICAN MACHINIST. But it ought not to be expected of me to furnish information in a private way, which calls for time, stamps, paper, and envelopes, just to be appreciated. Letters continue to arrive. Yesterday I received a check from a firm in Ohio, and I am in correspondence with two large iron works in England.

Since April 25th, 1885, much interesting information has been published in the AMERICAN MACHINIST on melting steel, especially articles from A. J. Stevens, General Master Mechanic Central Pacific Railroad, on "Utilizing Steel and Wrought-Iron Borings and Turnings," issue June 6th, also J. McKim Chace's article in June 13th issue, "Melting Treasury Steel Plates and Dies to Destroy Them." This is valuable information that many of us would never have known, had it not been for this article, in which he informs us that they "have melted this steel plate and dies for the past twelve or fifteen years," charging it into the cupola with a small portion of *cast iron scrap*.

In all that has been written, I must say that Thomas D. West, in his article in this journal, May 30th, 1885, on "Melting and Mixing Steel with Cast Iron to obtain Strong Castings," is the only one who has written and appreciated the full force of the question which heads this article, *i.e.*, melting steel alone.

Several years ago the writer had charge of a foundry making mining work, and we used considerable of the steel mixture in some of the work. It is easier to melt steel with part of the charge cast iron, than it is to melt steel alone, and it is easier to handle and pour after it is melted. I did not know of steel being melted *alone* in any ordinary cupola, nor could I find by the most diligent inquiry that it had been done before, until this discussion in the AMERICAN MACHINIST brought it out.

Now, we would like to hear from those who have had experience in melting steel or wrought iron of any kind in an ordinary cupola, without any cast iron mixture.

That this was accomplished long before the writer succeeded in doing it, the following from the Philadelphia *Evening Star* is evidence.

Editor Evening Star:

I smile as I read the article on "Using Old Steel Rails" in your issue of 22d inst., and knowing the honesty of your bright little paper, both in politics and the interest taken in our city's manufacturers, I write that you may tell Mr. Masters and the Columbus, Ga. people to stand back and have our own Philadelphia take the lead in this (to them) new idea.

The company I have the honor to represent have melted steel rails, wrought-iron rails, solid wrought-iron anvils (some of them weighing 400 pounds each), and other common wrought-iron scraps since 1875. As to plow and agricultural steel, that was being melted by us while your printers were setting up the notice of it.

Our output averages three million (3,000,000) pounds per year, making nearly thirty millions (30,000,000) of pounds melted by us before our friend Masters melted one pound. We have not been aware that steel rails are of no value. We would be glad to name a price for all the Baltimore and Ohio have.

We hold a medal and diploma from the Centennial Exhibition for a new industry, given us in 1876, and while like most Philadelphians, we are modest, "hiding our light under a bushel" (partly to keep somebody from stealing it), we don't propose Columbus, Ga., shall blow it out without a protest from Yours respectfully,

J. H. ARMBRUSTER,
Treasurer Philadelphia Tool Co.

A marked copy of this paper was sent to the Columbus Iron Works. Upon receipt of it I wrote Mr. Armbruster, and the following exchange of letters took place, which I give in full to convince manufacturers (some of whom have doubted) that this thing can be done and made profitable. It is no breach of confidence to present this correspondence, as it was started through the press. I am willing to close it through that medium, but prefer the AMERICAN MACHINIST, for the reason that it will go into the hands of more people directly interested in iron and steel industries.

OFFICE COLUMBUS IRON WORKS CO., }
COLUMBUS, Ga., April 29, '85. }

J. H. ARMBRUSTER, Esq., Philadelphia, Pa.

DEAR SIR,—We to-day received a copy of the *Evening Star* containing a letter from you, marked for special notice. I have no desire to take from you or your firm any honor that may be due you in regard to steel melting, and intended to have your letter republished in the AMERICAN MACHINIST, but thinking from your position in the Philadelphia Tool Company's office, that you were not a practical foundryman, I concluded to write you direct, to see if you understood the import of the article which was the basis of your letter to the *Star*.

We do not pretend to say steel rails or scrap were never melted before, but we have failed to learn of its being done in an *ordinary* or *common foundry cupola*, the same as is used in every foundry in the country for *cast iron*.

Will you be kind enough to write me if you melt the steel alone in this manner without the mixture of other metals, or send an account of your method to some reliable mechanical journal, like the AMERICAN MACHINIST. Will you also permit me to send a friend to your foundry, at some heat in which you melt heavy wrought-iron anvils and wrought scrap in a common cupola, to learn the percentage of loss on that class of scrap, or advise me yourself on that point.

I remain, yours truly,
ROBERT E. MASTERS.

PHILADELPHIA, May 2d, 1885.

ROBERT E. MASTERS:

DEAR SIR,—In reply to yours of April 29, I sent you the marked copy. I understood fully the import of your communication. We use an ordinary foundry cupola, and we took it after it had melted nothing but cast iron for years. It is quite small in diameter, and we suffer on that account. What we do, and how we do it, is ours (so long as we can keep it). We have kept it 11 years, but to give you a pointer, will say we *don't* use anything in the way of other metals. *Mark you*, all wrought-iron scrap, anvils, wrought rails, steel rails, malleable iron, anything you can pick out that you *can't* melt, run the furnace 9 hours at a stretch, give it to you hot enough to pour needles, give you a clean drop. The wastage you would not believe if I'd tell you. It costs lots of money to find it, as you will know if you try. Will let your friend see it, or teach it to you for $5,000. Don't propose to write to any mechanical journal. Don't calculate to let anybody steal it if we can help it. Sorry we seem so selfish, but I don't see any profit to this firm or me in giving away results that you or any other man can't get without much loss.

J. H. ARMBRUSTER,
Treasurer.

OFFICE ECLIPSE WIND ENGINE CO., }
BELOIT, WIS., May 15, 1885. }

J. H. ARMBRUSTER, ESQ.:

DEAR SIR,—Yours of May 2d was forwarded to me from Columbus, Ga. I am afraid, from the tone of your letter, you did not "understand the import of my communication." As I have melted some fifty tons of steel scrap in the last year, made successful trial heats of melting steel rails and poured the fluid metal into green sand moulds, and produced some very nice smooth castings of various kinds, I am not disposed to squander $5,000 for any information I have obtained from practical experience; but you seem so satisfied that you *alone* possess a knowledge of the art, I am willing and ready to deposit that amount against a like amount from you that you can't melt any class of metal you named that I cannot melt, and, as I did not steal the information from you or any other person, I feel at liberty to give the public the benefit of practice that was original with me, no matter how long it may have been practiced previous to my efforts. I do not wish to work and study for glory alone, nor am I of a disposition to shut myself up like a clam, because I can't go out of my shell nor want any one else to come in. Therefore, I gave the details of a heat in the AMERICAN MACHINIST, April 25th, and there is an editorial in that issue, also, in May 16th, on a trial heat of steel rails.

I confess my object in the publication of articles is the exchange of information on subjects relating to foundry practice, and it is a satisfaction to me to feel I have benefited some one, or the world is a little better off for my being in it. I never publish any of the firm's business I am with that they object to having made public, but any experiments that are original with me I feel at liberty to publish.

I can refer you to this firm—the Eclipse Wind Engine Co., Beloit, Wis.—who will testify that since I have been with them I have utilized all the old wrought scrap they had on hand. As I told you in a former letter, I did not want to rob you of any credit due you; therefore, if the AMERICAN MACHINIST will give space to our exchange of letters, I will let the public give you all the credit due, and I will only ask that portion they are willing to grant me.

Yours,
ROBERT E MASTERS.

The Schwartzkopff Universal Control and Safety Apparatus for Steam Boilers.

This is a device that, though quite simple in its construction, combines in itself the functions which so far have been divided between several appliances. It is intended to furnish reliable guard against all direct causes of boiler explosions by controlling the processes in the boiler, and giving an audible and visible sign in cases when such processes take an undesirable and even dangerous course; that is to say:

1. If the highest admissible steam pressure be reached or exceeded (thus controlling the steam gauge and the safety valve).

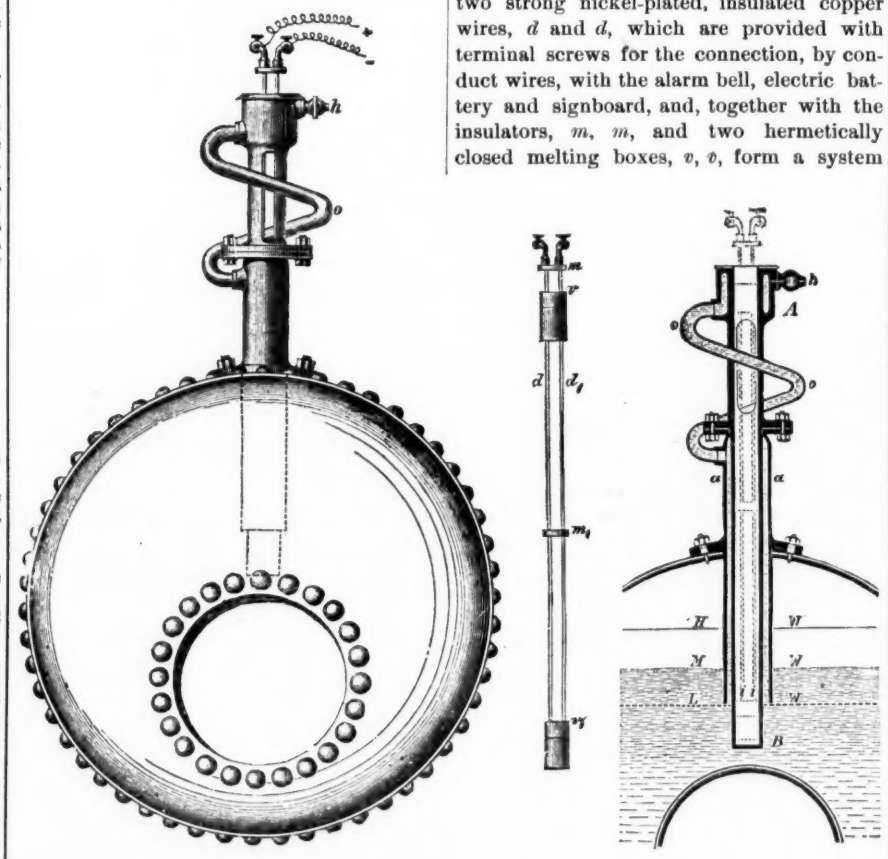
2. If the water in the boiler has sunk below the lowest admissible level (thus controlling all apparatuses for recognizing the water level).

3. If the water in the boiler should have reached a temperature which exceeds the one corresponding with the pressure shown by the steam gauge—*i. e.*, in case of a retardation of the ebullition.

4. If the boiler is being heated without containing any water at all.

For the cases noted under 3 and 4, no practical apparatus appears to have been devised heretofore.

The principle upon which the apparatus produces this variety of actions is that the heat of the steam or water in the boilers (or, in case of dry heating, the radiating heat of the boiler plates) melts certain alloy rings, which, when melted, produce a metallic contact between two otherwise insulated copper rods, thereby completing an electric circuit and bringing into action one or more rattling bells, and cause the falling of the number of a signboard, corresponding with the signaling boiler, thus indicating the boiler which is at fault.



The apparatus consists, as will be seen from the cuts of two concentric metal tubes, *a* and *i*, the inner one of which is closed at the bottom and open at the top, and which reaches down into the boiler to about half-an-inch from the highest fire-touched surface of the fire-box or fire-tubes. The outer tube is open at the bottom, and reaches down into the boiler to the lowest admissible water level.

There remains an open annular space of about half-an-inch all round between the two tubes. The same arrangement of concentric tubes, with an open annular space between them, is repeated at the head of the apparatus *A*, the latter and the lower part being connected by means of a winding tube *o*. The annular space in the upper and lower part is thus interrupted and reunited for the purpose of obtaining a greater cooling surface for the head of the apparatus at a smaller height.

The apparatus being fixed as shown, closes the boiler entirely, thus allowing the former to be controlled, to work, to be readjusted without the escape of steam or water, or without the necessity of interrupting the working of the boiler in the least. The inner tube is traversed from end to end by two strong nickel-plated, insulated copper wires, *d* and *d*, which are provided with terminal screws for the connection, by conduct wires, with the alarm bell, electric battery and signboard, and, together with the insulators, *m*, *m*, and two hermetically closed melting boxes, *v*, *v*, form a system which can easily be inserted into and with drawn from the inner tube. Into the two last-named boxes there are fixed two slit alloy rings, which are adjusted so as to melt at certain degrees of temperature, viz.: The upper ring melts at the boiling point of water, the lower one at a temperature slightly exceeding that one which corresponds with the highest steam pressure with which the boiler may be safely worked. At the head of the outer tube a small cock *h*, is fixed, by which the air contained in the annular space at the time of raising steam can be allowed to escape.

The apparatus is now put into operation under the following conditions:

The alloy of the top ring will melt and ring the bell as soon as the water in the boiler sinks slightly below the lowest admissible water level, as then the water in the annular space will no longer be kept therein, but fall into the boiler and be replaced by steam, which at once heats the head of the apparatus beyond the melting point of the upper ring.

The alloy of the lower ring will melt as soon as the temperature corresponding with the highest admissible pressure is reached, or just surpassed. This will take place:

1. By the heat of the water in two cases: (*a*) If the pressure of the steam exceeds the fixed limit. (*b*) If the water gets heated to a dangerous degree without the pressure increasing correspondingly (retardation of ebullition).

2. By the radiating heat of the boiler plates, in case of fire being got up without the boiler being properly filled with water.

In all these cases the molten metal produces a metallic contact between the rods, and puts the alarms into operation.

It will be seen from this arrangement, that the Schwartzkopff apparatus fulfills in every respect the task of controlling with certainty the state of water and steam for:

1. There is no movable part at all; it is fixed to the boiler and acts as a kind of signaling thermometer. As the danger of explosion originates in the heat of water and steam, and as the pressure of the latter is only a consequence of the temperature, it is certainly preferable to use the original cause to indicate impending danger. The danger of an outside incrustation of the apparatus is reduced to nil, as the water contained in the annular space will not circulate at all, but remain in a state of stagnation; besides all the surfaces of the same are arranged vertically, so that no sediment can settle on the same.

2. The sensitive parts, the alloy rings, are hermetically enclosed in the melting boxes, and thus not being exposed to any outside influence, keep their melting point for any length of time.

3. The apparatus closes the boiler entirely, and acts under the influence of heat only, preventing at the same time the escape of steam or water.

4. It is quite optional on the part of the boiler owner at what water level or at what excess of pressure the signal is to be given. The low water alarm will be given as soon as the level has sunk slightly below the opening of the outer tube, and this needs only being arranged wherever it is required; too high pressure will be indicated by the melting of the lower ring, which may be had of any melting point desired. Thus a boiler owner may choose his own ring, and have an over-pressure indicated by the alarm of 5 lbs. or 25 lbs. over the usual working pressure. In the case of dry heating the radiating heat of the boiler plates (in whose immediate vicinity the lower ring is fixed) will melt the latter long before any actual damage has been done to the boiler plates.

5. After having done its duty, the apparatus is readjusted in a few minutes, as only the rods need be withdrawn, the molten metal is poured out, a new ring (of the value of a few cents), is inserted, and the whole system is in working order again.

6. The apparatus can be inspected every moment as to its efficiency. A simultaneous touch by a piece of metal of the rods projecting out of the inner tube will prove at a glance whether the whole electric arrangement is in working order. By withdrawing the rods and opening the melting-boxes, the presence and state of the fusible rings can be ascertained; and by opening the small cock it will be seen whether the annular space is free of furs.

7. The stoker cannot alter the melting point of the rings, which are, therefore, beyond his influence.

8. By fitting one alarm bell at the boiler-house, and another at the office of the foreman or other superintendent, the signal comes not only under the notice of the stoker, but the irregularity in the working of the boiler is at the same time reported to some other responsible person, who may cause an inquiry into the causes and consequences. The Schwartzkopff apparatus has been generally accepted, and is widely used throughout Europe, as is shown by testimonials from prominent firms. Block & Pilgram, 17 Bond Street, New York, are sole agents in this country for the sale of this apparatus, and have in their office a model boiler fitted with it, which is open for inspection.

Columbia College Professor—"As a student of practical mining, what spade do you consider the very best?"

Student—"Why, the ace, of course."

(Suppressed sensation.)

The Flint & Pere Marquette Railroad have reduced the salaries of their engineers, conductors and trainmen ten per cent.

LETTERS FROM PRACTICAL MEN.

Sawing the Concave Surface of Staves.

Editor American Machinist:

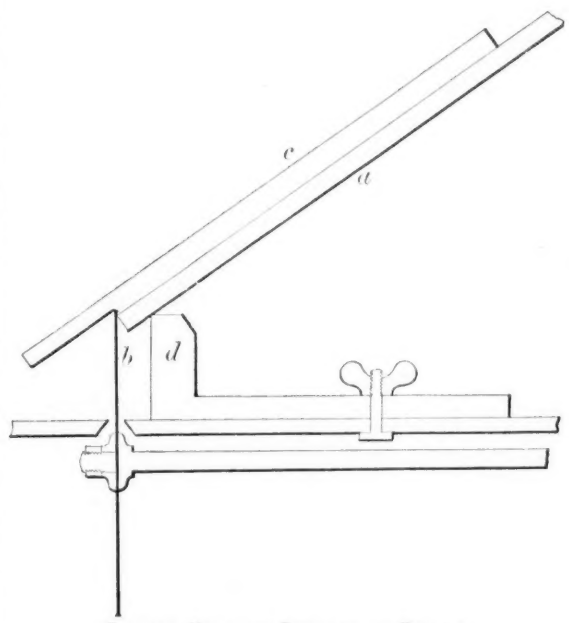
In your issue of June 20th, Mr. Frederick Leu does good service to the trade by his directions how to form the concave surface for staves on an ordinary circular saw. But if he will permit me to supplement his article, I would like to say that there are many other places about machinery where we wish to use staves besides making core boxes, and in my experience it quite as often happens that we want the staves to fit a circle larger than the saw, as smaller, and I think it is not generally known that this can also be done on the same saw by a very little contrivance. Take any odd piece of board or plank, and fasten it in any temporary manner on the top of the saw table in an inclined position, as shown in the accompanying sketch at *a*, *b* being the saw, *d* the ordinary saw gauge, and *c* the stave to be concaved. By changing the elevation of the piece *a*, and sliding the staves upon it across the top of the saw, any desired circle larger than the saw can be cut; or more strictly speaking, these curves will be sections of an ellipse and not of a circle, as will also the curves which Brother Leu gets smaller than the saw, but the difference from a circle will be so small as to make no practical difference.

For some kinds of work it may be necessary to remove the top of saw table, but if the staves are short, or if, as is often the case, they require to be concaved but a little way on each end, it can be done by simply reversing the staves and cutting one end at a time.

In this way I have frequently fitted staves for large drums upon a small saw, and made a good job and saved much time and "elbow grease."

J. C. GREEN.

Bartleyville, N. J.



SAWING CONCAVE SURFACE OF STAVES.

Counterbore and Facing Bar.

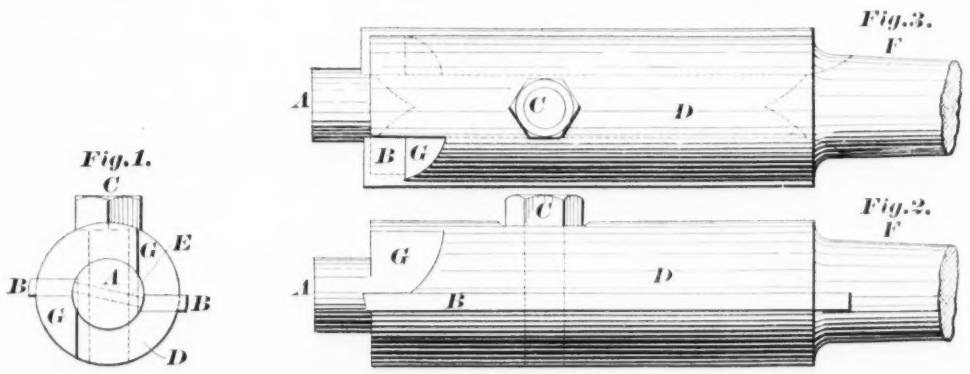
Editor American Machinist:

I enclose a sketch of a counterbore or facing bar, which is inexpensive both in making and keeping in working order afterwards. The cutters will not require replacing for a long time, and when this is required they are inexpensive to make, as will be readily seen. In the sketch, Fig. 1 is an end view of the bar; Fig. 2, a side view, edgewise of cutters; and Fig. 3, a side view, showing the flat side of cutters. *A* is the pin or guide, which is solid with the bar. *B B* are the cutters, which are inserted in slots on the side of the body, *D*, of the bar, running the extreme length to the taper shank, as shown. These cutters are plain pieces of flat steel fitted to the slot; the lower ends of these pieces form the cutting edges, and project sufficiently beyond the body, *D*, to give clearance to cut. The body, *D*, is cut out with a milling cutter at *G*, *G*, which gives room for the cuttings to remove freely. The cutting faces of the cutter radiate to the center of the bar, making the best possible cutting edge. The body of the bar, *D*, has a slot, *E*, sawed through it from opposite sides (as will be seen by dotted lines on Fig. 3), so as to remove as much stock as possible, making the two sides yielding. A bolt, *C*, passes freely through one side, and is tapped or screwed into the other side. By drawing up this bolt tightly, the two sides of the body, *D*, are sprung, and rigidly clamp the two cutters. The cutters can be quickly removed, and sharpened and replaced, as will be seen, and are readily adjustable as to length, so as to make both cutters cut equally. In order to make practically no wear on the pin, *A* can be turned smaller, and screw-threaded or left plain, and a hardened sleeve either screwed or pressed on it, which can be removed when too much worn and another replaced; but by hardening the pin made as shown, the wear is practically no consideration.

The writer made this style of a bar for use in the works where he is employed, and finds it to be great economy, as it is easily kept in order and the cutters will last a long time, as almost their entire length can be used up before needing replacing.

Another good feature is that the cutters are solidly backed at the cutting edge, consequently it is almost impossible to break them. We use the bars for facing bosses around holes where bolts are used, requiring true surfaces, but they can also be used for counterboring holes.

Being a constant reader of your paper, from which I get many good and valuable hints, I give the above kink, a production of my own, to all those who may see fit to avail themselves of the same. A. B. LANDIS.



COUNTERBORE AND FACING BAR.

Friction Pulleys.

Editor American Machinist:

In your issue of July 4th, Mr. S. W. Goodyear gave some very interesting testimony in favor of the much-abused friction pulley. I wish to ally myself with him in his able defence, and will give testimony of facts within my own recent personal experience.

I have, within the past year, aided in the production of a number of machines that, in the performance of their duty, have to be started and stopped between 10,000 and 13,000 times per day of ten hours. At every start about 500 lbs. of matter has to be set in motion at a speed of about 300 feet per minute, in addition to which there is a stress of work that probably doubles the resistance. These machines are driven by a friction pulley 16″ diameter and 4″ face. I will say of these pulleys that, in our hands, they have given no trouble whatever, beyond occasional adjustment for wear, except in one instance, when, upon examination, the friction faces were found to be untrue—the result of bad workmanship.

When these pulleys do this work day after day, is it not good evidence that friction pulleys *are* reliable and useful?

The bottom fact of the matter is, Mr. Editor, that there is a wide-spread prejudice extant among mechanics of the unthinking and "rule-of-thumb" class, based upon insufficient knowledge and unfortunate experience, personal or hear-say, of the imperfect working of the earlier types of these pulleys; and this experience, or lack of experience, has put them out of sympathy with the whole genera, and upon such unstable ground they are ever ready and glib in their condemnation.

Friction pulleys may be divided into two general classes or types, which comprehend the whole genera—those which clutch at or near the hub or center are one type, and those which grasp at or near the rim are the other. The individuals of the latter class are generally as good and useful as those of the other are bad and provocative of irascibility, as well as wasteful of time and means.

The points of a good friction pulley are: Simplicity, accessibility, simple and quick adjustment for wear, wearing parts broad enough for *economic* service, and cheaply-produced and easily-replaced wearing parts, particularly of the grip. Besides these desiderata, the matter of noise and clatter should receive attention.

BENJ. ADRIANCE.

Brooklyn, N. Y.

Disinfectant on the Pennsylvania Railroad.

Editor American Machinist:

Your letter of July 1st to Mr. Pugh, general manager, has been referred to this office for reply.

We enclose copy of specifications for disinfectants; also copy of circular issued by the general-manager, in relation to disinfection, for your information.

In regard to the formula for Pennsylvania Railroad disinfectant would say, that we do not think the method we use in manufacturing this material, would be available for the public to manufacture itself. It requires skilled knowledge to make the same. In lieu of this, however, the public can make its own disinfectant, containing the same materials as the Pennsylvania Railroad disinfectant, as follows:

Sulphate of zinc or white vitriol	1 lb. 3 oz.
Sulphate of copper or blue vitriol	1 oz.
Common salt	½ lb.
Water	6 pts.

This will make about a gallon of disinfectant of the right strength to use. If it is desired to make the disinfectant more concentrated, use one-half as much water, and dilute one-half when used.

I trust that the foregoing will meet your wishes.

THEO. N. ELY,

General Superintendent Motive Power.

[The above letter is in answer to an inquiry suggested by one of our readers, who thought that a knowledge of the disinfecting mixture used on the Pennsylvania Railroad would be of value to the public. We referred to the circular in a former issue. The specifications are directions for applying the mixture about the stations and cars of the railroad.]

Advice to "S. C."

Editor American Machinist:

I read with a great deal of pleasure the article of "S. C.," describing the forming of a class to study the laying out of patterns used in boiler-making, and I wish I was near enough to assist them. But as an old drift-pin driver, who has given the subject of the development of patterns some study, at night school, at home and at the bench, I will offer them a little advice: To start properly, let them lay aside, for the present, their text-books on elbows and domes, and study a little practical geometry. Learn how to erect a perpendicular to or from any point in a straight line; to construct all kinds of triangles and all regular polygons, and learn the names of geometrical figures. If they do this, they will be surprised how pleasant the study will become; then, when they take up their text-books on elbows, everything will be plain sailing; they will have no use for wooden rolls, and, when they lay off a sheet of boiler iron, they can sleep soundly, knowing it will come all right.

If the thermometer were not among the nineties, I am sure the editor would not accuse me of being "an offensive partisan." I would proceed, for the benefit of Tom, Dick and Harry, to order a boiler (on paper), and proceed to lay it out, from beginning to end. However, when the weather gets cooler, if the editor will give me space, I may try my hand. In the meantime, my best wishes are with "S. C." and his chums.

Augusta, Ga. DRIFT-PIN.

Not A New Brake.

Editor American Machinist:

In your issue of July 11, under heading of "Countershaft Brake," Mr. J. A. Hill makes mention of a new and useful brake as being used by Mr. H. Jones, of South Pueblo, Col.

I have noticed this amongst other handy contrivances on the E. Gould & Eberhardt patent shaper and hand lathe, which I believe they have patented long since.

OBSERVER.

In an interview with Mr. Alfred Davy, of Davy Brothers, steam hammer and general machinery manufacturers, of Sheffield, England, published in last Tuesday's Pittsburgh *Dispatch*, he says that "the products of the Pittsburgh mills are not excelled in the world," and that the only advantage Europe has over this country in manufacture is "cheap labor." He is correct. And while some iron workers are indifferent about tariff matter, let an adjustment of the tariff be made so as to put Europe on about an equal footing with this country, and skilled labor in our rolling mills will be compelled to come down in their wages to meet the difference or the mills must close. An adjustment of the tariff this winter will certainly be made, and it behooves iron workers as well as manufacturers to see that no such adjustment as will bring the wages of American workmen anywhere near those of Europe is made.—*National Labor Tribune.*

They have some hard experience in railroading in Texas. According to the Galveston *News* a train near Waldron was struck by a water-spout, the engineer and fireman abandoning their engine and taking to the trees to avoid a wave of water eight feet deep and 100 feet wide, coming head on. The locomotive and fourteen cars were carried 200 feet, and the roadbed leveled down completely. We are not sure that it was quite as bad as the *News* puts it, but it is reasonably certain there was a good deal of a shower in that particular locality.

Judging from a large number of experiments that have been made by the United States Government in the use of high explosives for charging shell, not so much is likely to come of their use as was expected by their advocates, although they may yet play an important part in modern warfare. It does not seem practicable to do much injury to armor plate with any charge likely to be used, unless the plate is deeply penetrated before the explosion. Some fifty different explosives have been used in the Government experiments.

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☞ *We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draughtsmen, and all those especially interested in the occupations we represent, on subjects pertaining to machinery.*

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NEW YORK, JULY 25, 1885.

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Educating Burglars in State Institutions.

The assertion is made in a number of daily papers that the best burglars' tools are imported from Europe. These papers no not keep well informed upon industrial progress in this country. Several years ago the most efficient instruments for house-breaking and safe-cracking were doubtless imported, but any experienced member of "the gang" would elevate his nose at the imputation of sending abroad for tools to "crack a crib" in these times of burglarious progress.

The fact is burglars are being regularly *educated at public expense in Government shops* in various parts of this country. They are given full instruction in mechanical work, and none know better than the burglars themselves, that the knowledge thus acquired is likely to prove useful to them when their periods of instruction are ended. It is a slur upon the intelligence of the domestic burglar, to spread the report that he has to get his best tools from England or France after enjoying all the privileges the State so generously accords him, to perfect himself in the mechanical work of his art. The English and French burglars have no such noble privileges afforded them by Government. Instead of being drilled in mechanical work while passing a season of retirement in prison, they are ignominiously kept at pounding stone, making roads and other work of like nature, which, although benefiting the community, does not draw out the latent mechanical talent of the crooks and assist their proficiency in "doing jobs" when turned loose again.

In Europe, government schools for instruction in mechanical work, are filled with free citizens; here, in order to obtain mechanical instruction at the expense of the State, it is necessary to commit a crime and be sentenced to prison. If there is any portion of the press of Europe that has pointed with admiration to the prison industrial system as generally practiced in this country, we have not heard of it. If the people of those countries where prison convicts are all employed directly upon Government work, are desirous of changing to the American contract system, not the slightest intimation of it has found its way into print. Here, on the other hand, the ring of prison contractors have a lot of daily and weekly newspapers to defend them, and apologize for the accursed system which is enriching these contractors and bringing a blight upon free industry.

But these newspapers do not represent the sentiments of the people. This was conclusively shown by the 140,000 majority given in the State of New York one year ago last fall in favor of abolishing the prison contract system. It was a direct vote upon the question. It is reasonable to believe that a like sentiment prevails in every State in the Union.

The question now is: How long will the people suffer corrupt legislators to defeat their expressed wishes in regard to the contract system?

General Machine Work.

The effort on the part of most machine-shop proprietors in this country, for the past few years, has been to change from general work to specialties—to convert the machine shop into a manufacturing establishment. In many instances, it looks as if the plan had been too well carried out. Shops that are ready for jobs out of the line of regularly manufactured specialties are, we believe, as a rule, better provided at the present with work than those engaged on specialties. There will always be room for a fair number of good shops, well fitted for taking hold of jobs not in any special line of manufacture. A certain proportion—not a small proportion either—of machine work is general in its character. Jobs, large and small, are constantly wanted that will never require duplication, and these naturally find their way to shops that are well provided for doing them at reasonable cost without special appliances. Again, there is always being constructed a large amount of experimental machinery, in which important modifications will be made before it passes to the stage of manufacture. The general machine shop should be able to bring this machinery up to the point of manufacture, and then pass it along to those who will arrange for systematic manufacture. Good tools, judiciously selected for this kind of work, and, above all, the best kind of shop management, is required for this. With these the general machine shop is not always the one that is left in the race for business. The ability to handle a variety of general work, so as to get it out well and cheaply, has come to be more of a specialty than the manufacture of any particular line of machinery. There is, in the future, fair prospects for the general machine shop, ready to take hold of a job without any red-tape preparation.

Some Plans for Selling Machinery.

Opinions differ about the best plan to sell standard machinery, as, for instance, machine tools. Necessarily, considerable machinery is sold through regularly appointed agents and general machinery dealers. A great many manufacturers are averse to consigning machinery to agents, and will strenuously oppose the consignment policy. Experience, however, has often been in favor of consignments. A member of a successful machinery firm informed us that he had found losses to be less by following the consignment plan, than by selling to agents and dealers. Agents who buy their stocks order a considerable quantity at a time, and probably ask and obtain long credit. In case one of them fails a short time after buying a stock of machines, the manufacturer cannot recover one of them, but must take his chances with the other creditors. If, on the other hand, the machines were only consigned, every one unsold could be taken back at once. When consigned machines are sold by agents, if the manufacturer is careful to require prompt returns he will avoid the risk of any large loss, such as might occur if the machines were invariably sold upon leaving the shop. The risk in selling to dealers is no greater than in selling to other parties, but in dull times, especially, the plan which involves the smallest and shortest credits is most desirable.

The firm here referred to, it should be noted, control their own business in selling as well as in manufacturing. They sell direct to users of machinery, as occasion offers, having no agreement with agents to exclude making sales from the shop. Furthermore, they take pains to keep the mechanical public informed as to their location and product, thereby popularizing their machinery under the firm name. Should occasion arise to change an agent, it can be done without the great trouble and annoyance of having to create a new reputation for the machinery in the territory covered by the agent's work. Credit for the character of the machinery they build belongs to the firm, and not to the agents in any part of the country. The agent sells on the firm's reputation for their product, his own reputation as a dealer being only auxiliary.

There are manufacturers of machinery—not, however, much known to the public—who pursue a selling policy directly opposite to the one above noted. All their product is sold to agents and the latter place the machines upon the market in their own names, thus ignoring both name and location of the manufacturer. They may make excellent machinery, but can never acquire a mechanical reputation while pursuing this policy. While they own a business of manufacturing, the business of selling is owned by others, and it is absolutely necessary to keep up the latter in order to continue the former. With them the great trouble and annoyance begin when the agent desires to change manufacturers and they are not able to make him concessions enough to continue. In such a case the manufacturers must face the problem of virtually starting a new business. They may make terms with a new agent who has an established trade, but the latter will demand, and, of course, must receive an equivalent, in the contract, for the position he has attained before the public. The agent, then, would doubtless have the lion's share of the profits, and the manufacturer would have to take the greater part of the risk.

There is another phase of the machine-selling question which has not received much public attention, although it has cost some establishments a great deal for experience. We can recall several manufacturers of machinery tools and supplies during a close observation for seven or eight years, who have tried the experiment of relying entirely upon agents, not only for the usual energy requisite for making individual sales, but also for all the expenses incidental to popularizing their productions by keeping them prominently before the mechanical public. We have never heard of an instance where such an experiment turned out wholly successful. There are many reasons why it would not be likely to do so. If there is competition, and there are few mechanical productions in which competition is not sharp—the manufacturer who relegates the labor and expense of the entire selling department to his agents will probably be outstripped in a short time by his competitor who uses his own means to push his productions into prominence and favor as well as availing himself of the aid of energetic agents. The former may offer tempting discounts and may produce articles of recognized excellence, but even these advantages are crowded aside every day by competitors who act upon superior plans for popularizing their productions and effecting sales to both new and old customers.

Mechanics have to deal with such solid matters of fact, and so little with mere speculation, that it seems strange to find any of them given to superstition. Yet we occasionally hear of instances in which mechanics have exhibited their belief in unlucky omens, and even in the appearance of spirits, which are not of the ardent kind. We have known of the refusal of a whole body of workmen to start a new shop on Friday, and the horse-shoe has been nailed over many a shop-door, "just for luck," by those who would resent the imputation of being superstitious. A story is now being circulated about the queer antics of a ghostly engineer upon the Pennsylvania Railroad. An engineer who had been in the habit of slowing up and blowing the whistle when passing his own house was killed in a collision. His successor could not prevent the engine from going through the same performance every night when passing the house. Some unseen power helped him at the throttle lever and started the whistle blowing. One night he and the fireman both grasped the lever, and held on to it while passing the house. Suddenly the lever was wrenched out of their hands, and pulled out the utmost limit. Away went the train, the engine shrieking, and, before they could get it stopped, it ran upon a switch in Altoona, and wrecked two or three cars that were standing there. Then the engineer, not being able to satisfy his superiors on the road that the ghost alone was responsible for the damage, left, and took a position on another road. This is the essential part of the story, but we will not vouch for its accuracy, leastwise not as far as the ghost is concerned.

On another page of this issue Robert E. Masters relates some of his experience in giving away his discovery of melting steel in an ordinary cupola. A Philadelphia establishment, which has kept its process a secret, claims to be able to cast what Mr. Masters cannot, and asks $5,000 for the secret. But Mr. Masters offers to put up $5,000 against a like amount, that he can cast anything the Philadelphia establishment can. Furthermore he has made his process public through the columns of the AMERICAN MACHINIST. We feel confident that Mr. Masters can do what he claims he can do in his article this week. The Philadelphia Tool Company is invited to take up his proposition. If they do, we shall be pleased to inform our readers of the result.

Literary Notes.

Among our industrial exchanges none bear evidence of greater progress during the past year than the *Industrial Journal*, of Bangor, Me. It is filled with live news of Maine industries every week, and is making the commercial and manufacturing interests of that State known in a way that will certainly benefit them.

The Cincinnati *Artisan* is a live monthly publication which gives considerable useful matter for machinists and engineers. It is neatly printed. Subscription price $1.00 a year.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.

(214) **H. P. J, Columbus, Ga., writes:** A friend of ours is feeding water to his boiler through a perforated pipe hung up in the steam space above the water line Is not such a plan of feeding calculated to give wet steam? *A.*—Our opinion is that the tendency is to give wet steam. We should dispose the pipe below the water line.

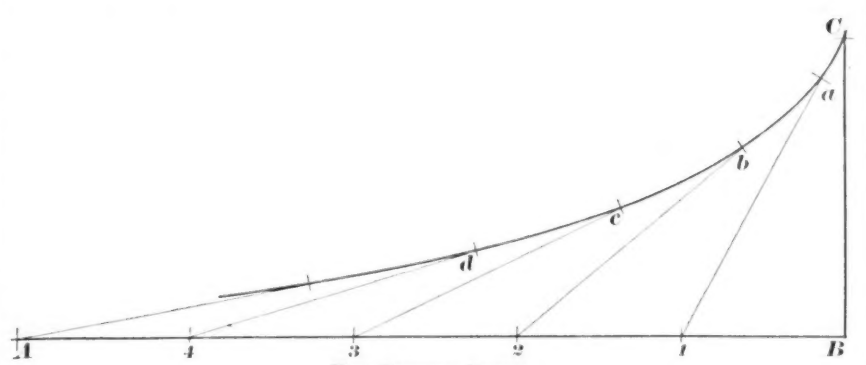
(215) **W. T., San Francisco, Cal, asks:** In reference to steam, what is meant by absolute, initial, and terminal pressures? *A.*—Absolute pressure is the pressure from vacuum. An ordinary steam gauge shows the pressure above atmosphere; if to this is added the pressure of the atmosphere, very commonly considered as 14.7 lbs. per square inch, we have absolute pressure Initial pressure is the pressure of steam in the cylinder of a steam engine at or near the beginning of the stroke of the piston. Terminal pressure is the pressure that would be in the cylinder at the end of the stroke if the exhaust-valve had not opened.

(216) **M. J. B., Yarmouth, N. S, asks:** 1. If a railway car is consumed by fire so that nothing is left but the iron work, what effect would the fire have on the chilled wheels, and would it be safe to put such wheels under a car again? *A.*—This can only be determined by observation. Very likely the wheels may not be injured. 2. Are car springs reset, as good as new ones? *A.*—A smith skilled in spring work will, if the springs have not been overheated, make them about as good as new. 3. How much compression will ten tons' weight give the springs under a ten-ton car? *A*—We cannot tell. You can determine by placing weights on the springs.

(217) **P. Providence, R. I., asks;** 1. What is the ultimate tensile strength of cast iron, wrought iron, steel, brass, and gun metal? *A.*—It varies with the quality. Cast iron from 18,000 lbs. to 45,000 lbs. per square inch of section; wrought iron, from 39,000 to 70,000; steel, from 40,000 to 135,000; brass, from 20,000 lbs. to 60,000 lbs.; gun metal (bronze), about the same. 2. What fraction of ultimate strength is generally allowed in use? *A.*—From ¼ to 1-10, depending upon circumstances. Your questions on gearing cannot be answered in a general way. You can only understand the matter by studying it. The table of cutters to which you refer, give the limit as to the number of teeth that should be cut with a single cutter. You may take it for granted that you cannot improve on this, at least not until you have given the subject a good deal of hard study.

(218) **J. M. E., Philadelphia, Pa., asks:** 1. How may the Schiele curve be traced? *A.*—Draw the line BC of any length at the extremity of and perpendicular to A B Take any number of points equi-distant, 1, 2, 3, etc., on A B. Draw the line 1C, and from 1 lay off the distance 1*a* equal to B C; *a* is a point in the curve. Next draw the line 2*a*, and set off 2*b* = B C. Continuing this, points will be established through which the curve may be traced. The divisions of the line A B should be much more numerous than represented 2 How may I know if the crankpin of a steam engine is in line with the journals? *A.*—Disconnect the rod at the cross-head and remove the brasses, then key up at the crankpin, so there is no lost motion. Bring the cross-head up to the stub end, and measure from one side of the stub end to the shoulder of pin. Turn the crank to other positions through an entire revolution, and if the measurement remains the same the pin is true, if the guides are in line.

(219) **F. K. U., Jersey City, N, J., asks:** 1. I have a vertical boiler 30″ diameter and 60″ high, with 60 tubes 1¾″ diameter, 46″ long. What should be the horse-power of such a boiler? *A.*—As near as we can understand your description, such a boiler should be rated at about 8 horse-power. 2. How much heating surface is allowed for a horse-power in such boilers? *A.*—A common allowance is 12′. 3. What would be good proportions for a stack for such a boiler, with exhaust from engine in the stack? *A.*—A pipe 11″ diameter, 30 feet high, will give good results. 4. The exhaust pipe is 2½″ diameter. To what should it be contracted for blast in the smoke-stack? *A.*—Taper it down to about 1″. 5. The engine is 8′x10″, running at 120 revolutions. Without the governor it will run with 25 lbs. steam. I calculate it is developing 7 or 8 horse-power. Am I right? *A.*—Probably 6 horse-power would be nearer right. 6. The valve on engine does not cut off steam until within 1 inch of end of stroke. Can I not save steam by putting in a valve to cut-off at ¾-stroke, and would I not be able to get nearly as much power as now; and would any alterations in valve-seat be required? *A.*—A valve to cut off at ¾-stroke would give nearly as much power as you get now, and would save some steam. You would probably require a new eccentric; perhaps there is not room enough in the steam-chest for the increased travel that will be required. The valve must be fitted to the seat. Whether any alteration in seat will be required can only be told after examination.



THE SCHIELE CURVE.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Curtis Pressure Regulator and St'm Trap, July 4, p 15

Edw. Sears, wood engraver, 48 Beekman, St., N.Y

Presses & Dies, Ferracute Mach.Co., Bridgeton, N. J.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass

The Best Upright Hammers run by belt are made by W. P. Duncan & Co., Bellefonte, Pa.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Improved Labor-Saving Upright Drills; prices reasonable. Currier & Snyder, Worcester, Mass.

The latest Improved Tack and Match Machinery is made by White Machine Co., Waterbury, Conn.

"How to Keep Boilers Clean." A book mailed free, by James E. Hotchkiss, 86 John street, N. Y.

Universal grinders for lathe-centers, chucks, angles, or cylinders. C. C. Hill, 84 Market st., Chicago, Ill

Tools for amateur and foot-power lathes. Send for illustrations. Hartford Tool Co., Hartford, Ct.

Light fine interchangeable mach'y to order. Foot lathe catalogue for stamp. E. O. Chase, Newark, N.J.

Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn.

Foot Power Machinery, for workshop use, sent on trial if desired. W.F. & John Barnes, Rockford, Ill.

Pattern and Brand Letters. Vanderburgh, Wells & Co., corner Fulton and Dutch streets, New York.

Largest and best Portable Forge on the market, $10.00 each. American Tool Co., Cleveland, Ohio.

Engine Lathes, Hand Lathes, and other fine tools. Assortment large; prices low. Frasse & Co., 62 Chatham St., N. Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Farley's Reference Directory of the Machinists, Iron, Steel, and Metal-Working trades of the United States. A. C. Farley & Co., Philadelphia, Pa.

Files recut without drawing temper, about one-half usual prices; samples recut free; prices on application. The Acme Co., Collinsville, Conn.

The outline ("wax process") engravings shown in the AM. MACHINIST each week are made by Struthers, Servoss & Co., 24 to 34 New Chambers St., N.Y

"Complete Practical Machinist," $2.50; "Mechanical Drawing Self-Taught," $4. Books for workmen. Joshua Rose, Box 3306, New York City.

Morrison's Practical Engineer, a complete treatise on steam and general machinery. Price, $1; mailed free. Indicators, Engineers' Instruments and outfits. W. A. Morrison, Box 373, Lowell, Mass.

Locomotive Engine Running and Management By Angus Sinclair. Gives full directions about handling and repairing locomotives; instructs how to design valve gear and set valves; Westinghouse air brake explained by aid of engravings. Price, $2. For sale by *National Car Builder*, 187 Dearborn St., Chicago, Ill.

Every young man who aspires to be either a mechanic, merchant, or manufacturer, owes it to himself that he become thoroughly familiar with the writings of Chordal. John Wiley & Sons, 15 Astor Place, N. Y., have issued a new and enlarged 12 mo. edition of "Extracts from Chordal's Letters." Handsomely bound in cloth, with over 50 illustrations. Price, $2. Discount of 25 per cent. on orders for five or more copies.

MANUFACTURES.

Ives & Pond, Cambridgeport, Mass., are putting up a five-story piano factory, to cost $50,000.

Geo. Watson, of Jersey City, N. J., will erect an $8,000 factory on Railroad Avenue, in that city.

The Atherton Machine Co., Lowell, Mass., have bought the tools of the Lanphear Machine Co., Phenix, R. I.

F. W. Wolf is erecting a two-story factory in Chicago, at 336 Hawthorn Avenue, to cost $10,000. It will be 62x150 feet.

The Rugby Pipe Works Company, of Rugby, Tenn., will, July 15, start work on pipe works. Estimated cost, $15,000.

The Camden Iron Works has received a contract for 250 miles of 20-inch pipe for a pipe line from Pittsburgh to Philadelphia.

Machine shops are being erected at Jacksonville, Fla., by the Jacksonville, Tampa & Key West Railroad Co.—*The Tradesman.*

A pair of steel boiler-heads, 102″ in diameter and ½″ thick, were rolled at the Spang Steel and Iron Works, Pittsburgh, recently.

The Pratt & Whitney Co., Hartford, Conn., are making an 1,800-pound hammer with a 10,000-pound anvil, for Philadelphia parties.

The Southern Machine Company, of Shelbyville, Tenn., are nearly ready to begin putting in their foundry and machine shop plant.

The Grand Rapids (Mich.) Manufacturing Co., recently burned out, will rebuild, and continue to manufacture agricultural implements.

It is reported that the Chicago & Northwestern Railroad is erecting a roundhouse and other buildings, to cost $200,000 at Belle Plain, Ia.

Dan Phelan has purchased ground in Vicksburg, Miss., and commenced the erection of a two-story building to be used as a carriage and wagon manufactory.

Rumsey Bros., of Lynn, Mass., are erecting a new factory next to their present quarters. It will be 110 feet long, 35 feet wide, and four stories in height.

R. Armiger & Son will erect a four-story brick factory, 33x70 feet, on Greenmount Avenue, Baltimore, Md., and a four-story building, 50x73 feet, in the rear.

The Ralston Ginning Co., W. L. Covel, general manager, Nashville, Tenn., expect to erect works in that city, but at present their gins will be made upon contract.

It is said that the Wheeling Steel Works and Wheeling Nail Works, recently incorporated at Wheeling, W. Va., will erect steel works, at a cost of $200,000 to $250,000.

The Diamond State Iron Company, Wilmington, Del., are building an addition to their rolling mill, to contain two trains of rolls for small merchant iron in extra lengths.

The Long & Bro. Chair Co., Louisville, Ky., have sold their factory to a syndicate, represented by Wm. Kaye, for $26,500. The new company has a capital stock of $100,000.

George B. West, Mt. Holly, N. J., writes us that he has started a shop in that place, and is putting in tools for the manufacture of light machinery and job repair work of all kinds.

The machinery of the cotton seed oil mill, Raleigh, N. C., will be put in a new two-story building 85x45 feet, now being built, the old building being used for the manufacture of fertilizers.

The Lincoln Iron Works, Rutland, Vt, are building a brick addition to their foundry, which, when completed, will double its capacity. The addition will measure 40x22 feet, and be two stories high.

G. A Gray, Jr., & Co., Cincinnati, Ohio, machine-tool manufacturers, write us: "We have hoped, month by month, to see an improvement in business. It has improved in quantity, but prices are very low.

The ammonia absorption ice machine exhibited at the New Orleans Exposition by the Columbus (Ga.) Iron Works Company, was bought at the close of the Exposition by a company in Apalachacola, Fla The machine was shipped to that place.

The Macon Cotton Seed Oil Mills Co., Macon, Ga., have decided to enlarge their business, and will erect a building for the manufacture of fertilizers, and also one for the manufacture of soap. Work will probably begin at once.

The outlook for manufacturing and other business is said to be good in the South. The cotton crop is good, and corn crop big. It is expected that considerable machinery will be bought for Southern use this fall, or sooner.

Wm. Flesh, of Philadelphia, reported last week as prospecting in Birmingham, Ala., has, with Mr. G.W. Lomb, Birmingham, Ala, incorporated the Birmingham Stove Co., capital, $15,000, to manufacture stoves. Will erect a factory.—*Baltimore Manufacturers' Record.*

Allen, McEvoy & Co., is the name of a new firm who have lately started a machine shop in Beloit, Wis. They make a specialty of the Belge park and Boulevard lampposts, pumps and cylinders. Their castings are made at the foundry of the Eclipse Wind Engine Co.

We have received from Joseph Dixon Crucible Company, of Jersey City, a small packet containing a sample of "Dixon's Perfect Lubricator," (dry, foliated American graphite), manufactured by them. They will send a similar sample packet free by mail to any person asking for it.

The old car wheel works of John L. Gill have been sold to the Gardner Bros., of Pittsburgh, Pa., and a large force of men are at work putting the buildings in shape for the manufacture of gas fixtures, tanks, valves, etc., for the gas works and for natural gas. 250 men will be employed.

The Smalley Manufacturing Co., of Manitowoc, Wis, inform us that they are erecting $10,000 shops of the following dimensions: Foundry, 50x56 feet; machine shop, 35x86 feet, with basement and first and second floors. Their business is mostly on ensilage and fodder-cutters.

The machine shops of McIntosh, Hemphill & Co, which have only been working seven hours a day, will begin work on double turn immediately They have just received two large orders from Iowa, and one from Ohio, which will keep them at work some weeks. The force will be increased to 300 men.

The Westinghouse Air Brake Company have received an order from the Chicago, Burlington and Quincy R. R. for 400 additional sets of automatic freight-car brakes. When this order is completed, the C. B. & Q. R. R. will have 520 sets of these brakes in use. It is said that they are giving very good results.

The Katahdin Iron Works, at Lewiston, Me., will soon resume on a much larger scale than heretofore The furnaces are expected to blow in, and the works to be in complete operation in October or November. The plans provide for rebuilding with a capacity of a daily output of 20 tons, or double the former capacity.

P. J. Sorg & Co., Middletown, Ohio, have commenced a mammoth new addition to their extensive tobacco factory, which, when completed, will make it the largest establishment of the kind in the United States, with the exception of that of Lorillard, in New Jersey, which is the largest in the world.—*Boston Commercial Bulletin.*

The Nashville *Artisan* says: "Reports received by us from various sections of the South indicate a moderate revival in industrial interests. While machinery drummers who are traveling in the South report business as dull, they agree that there are more inquiries than for some time back. While there is considerable improvement, buyers are insisting on low prices, and are asking for quotations from all makers before closing contracts. Woodworking machinery seems to be in better demand than any other line existing, though the individual purchases are for the most part small, consisting principally of additions to small plants. The sales of iron-working tools are moderately brisk, and we predict a large increase in this direction during the coming fall. We are led to this belief by the fact that this line has not kept apace with the general manufacturing development in the South, and the demand is every day becoming more imperative."

A recent issue of the Baltimore *Sun* says: "Messrs. Poole & Hunt, engineers and machinists, have constructed at their shops at Woodberry some powerful machinery for the Chicago cable street railways. The cable roads are a success in that city, and the company is adding a thousand more horse-power, and extending the lines seven miles further. Poole & Hunt have shipped three great wheels for the operating apparatus, one of them weighing 90,000 pounds. Another great gear-wheel in one piece, with double arms, weighed 27,000 pounds, and was the largest ever made in this country. The mate to it weighed 17,000 pounds. The firm have furnished a good deal of other work for the operating apparatus which they contracted to supply. They furnished the operating apparatus for the Kansas City cable road, which is now running, and for the Hoboken and New York Tenth Avenue roads, which are completed, but not yet in operation. Mr. German H. Hunt says the first cost of cable roads is large, but when properly built they are a success, and more of them will come into use soon. The cable road experiment in Philadelphia was less satisfactory than in Chicago because of faulty construction. The winters are more severe in Chicago, and frost damage can there be at its maximum. Yet the Chicago Company has met with success, and is spending large additional capital to increase the cable road service."

A large stove foundry is to be erected at Freeville, N. Y., by the Freeville Stove Works Company.

The Chicago, Rock Island & Pacific car shops at Trenton, Mo., have been destroyed by fire. Estimated loss, $150,000.

The Dickson Manufacturing Company, of Scranton, Pa., have recently acquired the sole right to put the "Stockport Gas Engine" on the American market. The engine is an English invention, which has been brought out in England within the past year or two. A feature of this engine is the use of a mixing cylinder at the crank end of frame, the two pistons being rigidly connected. Into this mixing cylinder the charge of gas and air is first received, where it is mixed and partially compressed; it then passes to the main cylinder end, where the compression is completed. An explosion occurs at every stroke of the engine; a charge is always ready for starting, so that a partial turn only of the wheel is required in starting. The details of this engine seem to have been well worked out, and its appearance is neat. It is understood that the Dickson Company will manufacture them in sizes from ⅛ to 30 horse-power.

Machinists' Supplies and Iron.

NEW YORK, July 9, 1885.

The general character of the supply business remains unchanged. There is a fairly constant but moderate business done on small margin of profit. Users continue to buy only for immediate wants, and in turn dealers' orders from manufacturers are for unusually small lots.

Iron—It has been apparent for some weeks that the market for American Pig was not entirely steady, and that quoted prices were not well maintained. This has finally culminated in a reduction of the price of No. 2 Foundry from $17 to $16 by the Thomas Iron Co. This reduction comes from strong competition, and a production beyond the needs of trade. The only effect this reduction is likely to have is, to render buyers still more cautious about buying beyond immediate consumption. No. 1 Foundry is still quoted at $18, but buyers say it can be had for $17.50. Grey Forge sells at furnace for $14 to $15, with production beyond the very moderate demand.

Scotch Pig—There is hardly enough doing in Scotch pig to insure quotations. Sellers are very generally willing to make concessions, but even then there is no life in the business. We quote Shotts, $20 to $20.50; Coltness, $20 to $20.50; Glengarnock, to arrive, $18.50 to $19; Gartsherrie, $20; Summerlee, $20 to $20.50; Cambroe, $18.50 to $19; Eglinton, $17.50 to $18; Langloan, $20 to $20.50; Dalmellington, $18.50 to $19.

Copper is in small demand. Lake is quoted at 11¼c. to 11¼c., but buyers are disposed to bid less. Other brands are quoted at 10⅝c. to 11c.

Lead—The market for pig has materially strengthened within the past week, being held at 4c. to 4¼c.

Spelter—Refined, 8c. to 8⅝c.

Tin—Owing to advances in London, the tendency of sellers is toward slightly higher prices. Jobbing lots of Banca have sold at 21½c.; Straits and Malacca, 21⅜c. to 21⅝c.

Antimony—Hallett's, 9c.; Cookson's, 9¼c. to 9⅝c.

✻WANTED✻

"Situation and Help" Advertisements, 30 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Wanted—Situation as foreman or superintendent of machine shop. Lock Box 568, Philadelphia, Pa.

Wanted—Situation as foundry supt. or foreman. Best reference. Address Founder, AM. MACHINIST.

A thoroughly practical mech. engineer, designer and draftsman is open for engagement; specialty, steam engineering; also well posted in other lines. Address U., AM. MACHINIST.

Wanted—An energetic young man, with some mechanical knowledge, for shipping clerk in a machine manufactory. State age, experience, references, and wages expected. G., AM. MACHINIST.

Wanted—Competent man to superintend construction of printing machinery and take charge of drafting-room. Must have had experience in above line. Address, stating age, experience, education and expectations, "Press," AM. MACHINIST.

✻ MISCELLANEOUS WANTS ✻

Advertisements will be inserted under this head at 35 cents per line, each insertion.

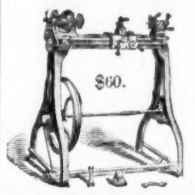
The Crescent Steel Tube Scraper is king. Crescent Mfg. Co., Cleveland, Ohio.

3x4 yacht engine castings. Send stamp for price list. J. L. Lucas, Waterbury, Conn.

To make room for larger tool, will sell cheap, for cash, a planer 42"x42"x12', in good order. Address P. O. Box 3085, Bridgeport, Conn.

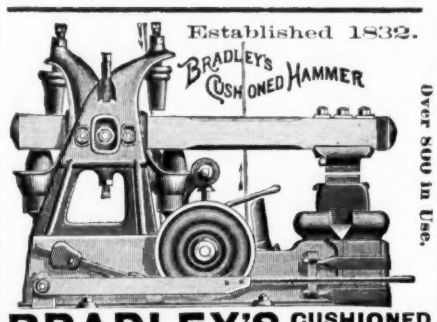
CHANDLER & FARQUHAR,

177 & 179 Washington St.,
BOSTON, MASS.



TOOLS AND SUPPLIES
—FOR—
Machinists, Plumbers, Gas Fitters, Electricians, Model Makers, Roller Skate Makers, Amateurs, etc.
Send for Catalogue B.

Established 1832.



BRADLEY'S CUSHIONED HAMMER.

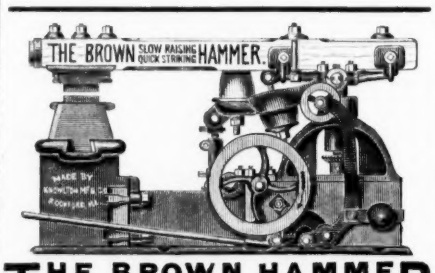
Stands to-day without an Equal.
It approaches nearer the action of the Smith's Arm than any Hammer in the WORLD.

SPECIAL NOTICE.

All parties making, selling or using an Upright or Helve Power Hammer having a Cushioned Vibrating Saddle, infringe our patents, and we shall hold them legally liable for the same.

BRADLEY & COMPANY, Syracuse, N. Y.

GUILD & GARRISON,
BROOKLYN, N. Y.
STEAM PUMPS,
VACUUM PUMPS,
AIR COMPRESSORS.
SEND FOR CATALOGUE.



THE BROWN HAMMER
STRIKES A BLOW WITH
DOUBLE THE VELOCITY That it Raises the Hammer
A NEW MOVEMENT! SEND FOR DESCRIPTION.
KNOWLTON MFG. CO., King St., Rockford, Ill.

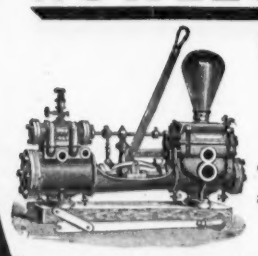
The Fireman's Guide.
A Handbook on the
CARE OF BOILERS
By KARL P. DAHLSTROM, M. E.
Crown 8vo, Cloth, 50 Cents.
E. & F. N. SPON, 35 Murray St., New York.

50 Per Cent. of time and labor saved by using this solid, strong, durable, quick-working Vise. Has the improved taper, pipe and other attachments. Sold by the trade. Send for circular.
MELVIN STEPHENS, Prop'r, Office, 41 Dey St., New York.

FOR SALE AT A BARGAIN.

A well established and good paying machine shop and foundry, including buildings, lots, machinery and stock, situated in Leadville, Col. The business will be carried on until sold, thus at once giving a profitable trade to the purchaser. Address,
A. FALKENAU,
Care of Dickson Mfg. Co.,
Scranton, Pa.
Only reason for selling, ill health.

KNOWLES PATENT STEAM PUMP



THE STANDARD.
THE BEST MADE PUMP.
THE BEST PUMP MADE.

Estimates furnished on application for Pumping Machinery of any capacity, and to work against any pressure. Air Pumps and Condensers for steam engines a specialty. Will save from 20 to 30 per cent. fuel.
SEND FOR ILLUSTRATED CATALOGUE.
ADDRESS,
93 Liberty Street, New York. KNOWLES STEAM PUMP WORKS. 44 Washington St. Boston, Mass.

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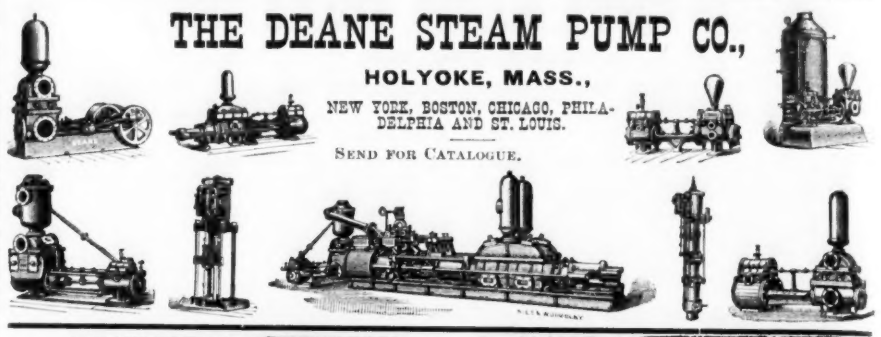

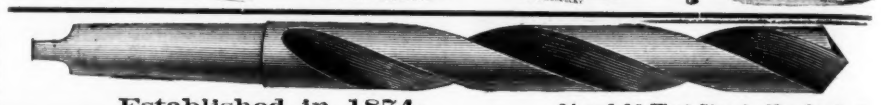

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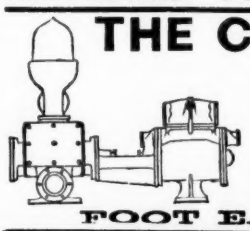

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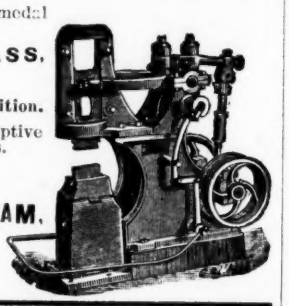

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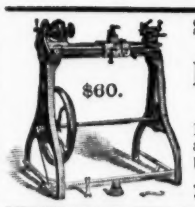

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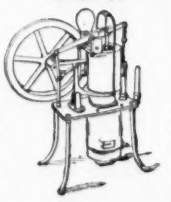

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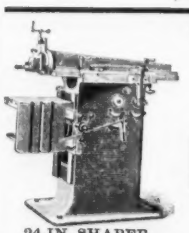

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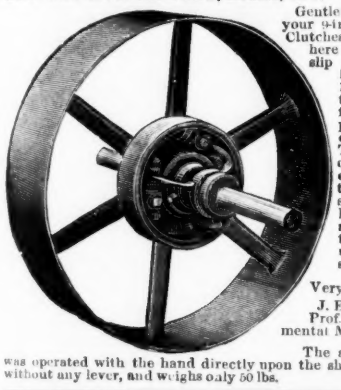

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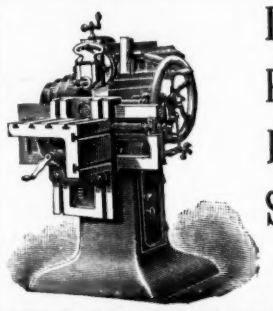

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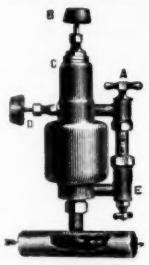

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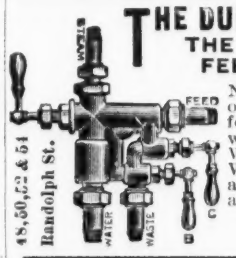

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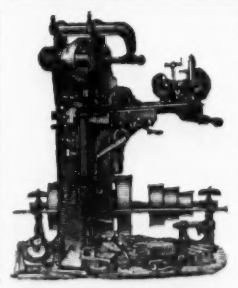

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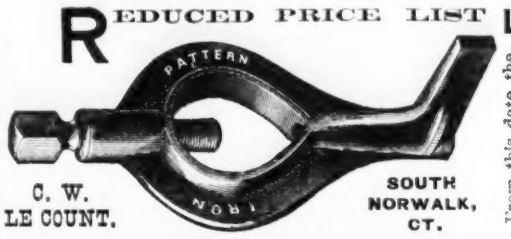

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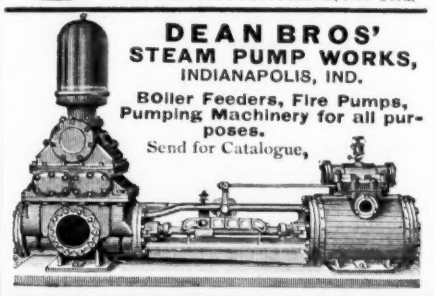

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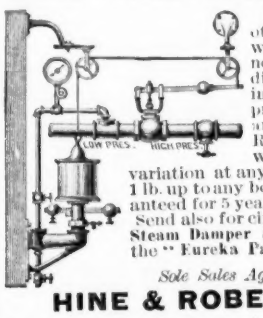

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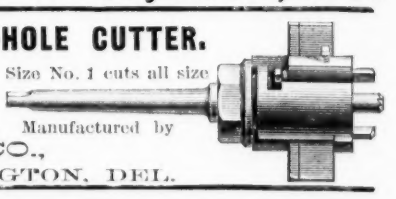

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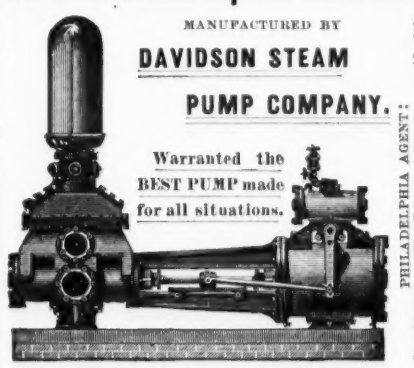

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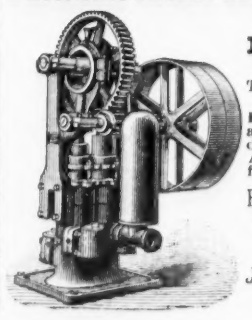

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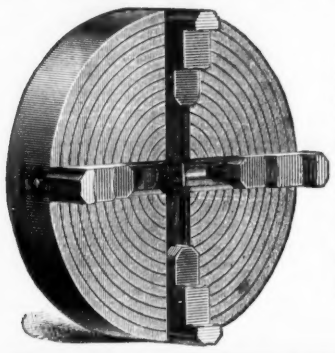

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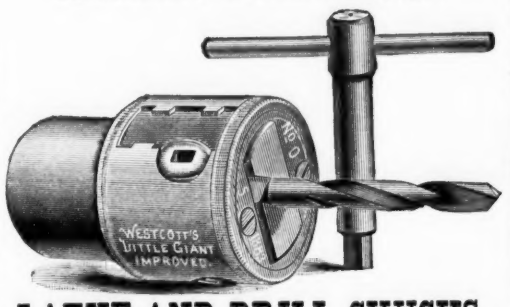

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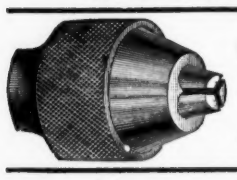

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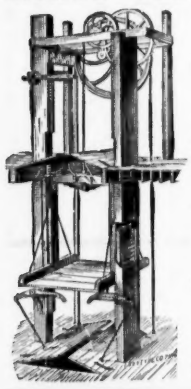

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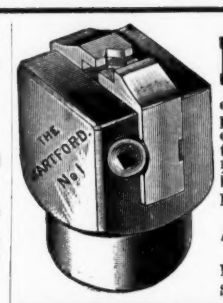

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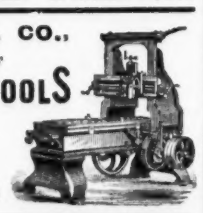

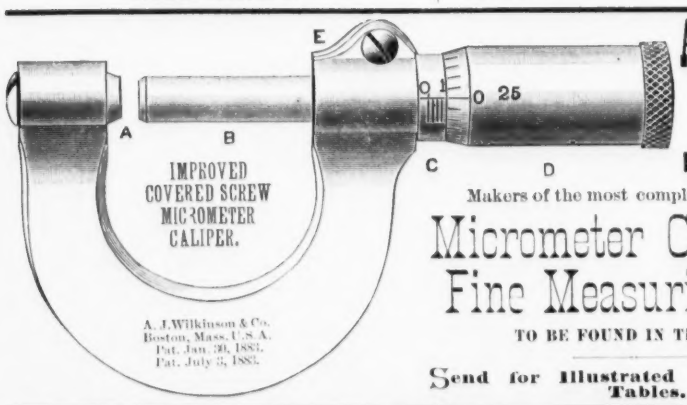

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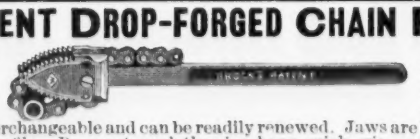

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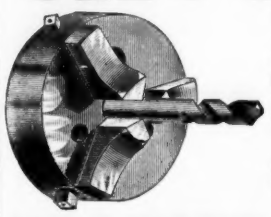

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Locomotive Economy. January 17, 1885
American Locomotives Built in 1884. January 24, 1885
Railroad Snow Plowing. January 19, 1884
How the Fastest Train in America is Run. January 5, 1884
Work of Pulling a Heavy Freight Train. November 22, 1884
Water for Locomotive Boilers. September 20, 27, 1884
Efficiency of Brakes. January 10, 1885

J. C. Hoadley.

Unbalanced Bodies in Revolution. March 14, 1885
Diagram Showing the Inertia of the Reciprocating Parts of the Steam Engine, June 7, 1884
Inertia of the Reciprocating Parts of the Steam Engine. June 7, 1884; September 13, 1884.

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Draft Regulating Appliances. March 15, 29; April 12, 26, 1884
Fitting Locomotive Wedges. August 16, 1884
Driving Boxes and Wedges. September 27, 1884
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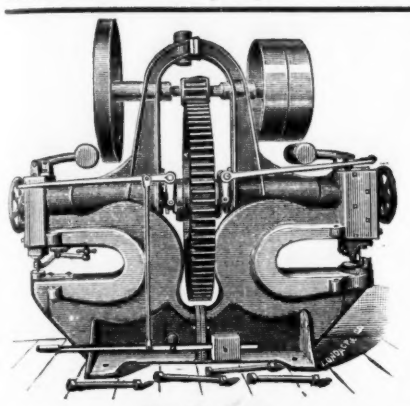

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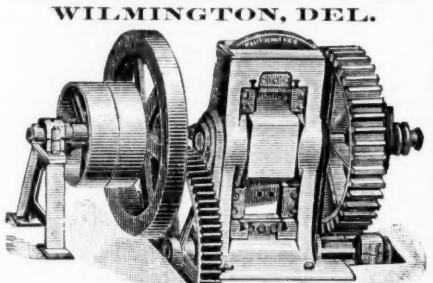

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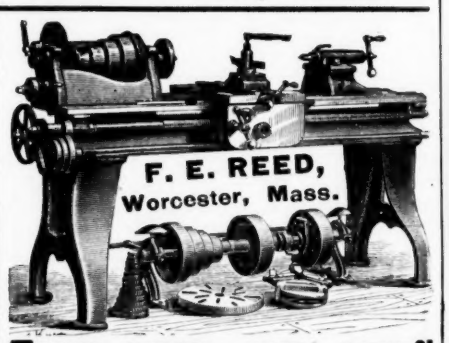

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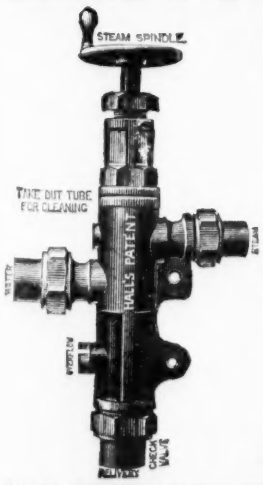

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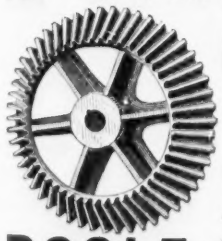

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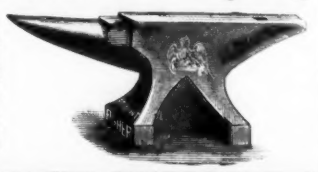

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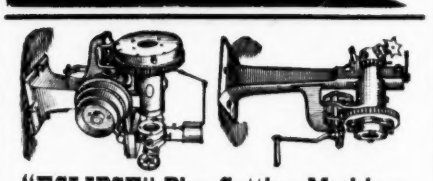

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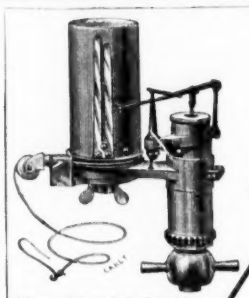

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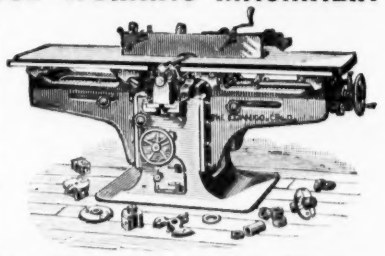

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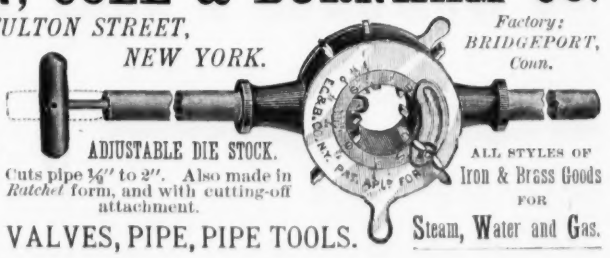

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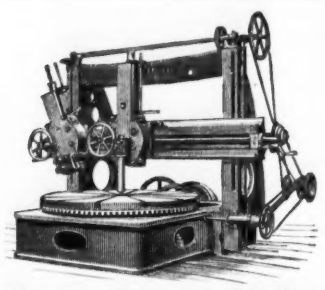

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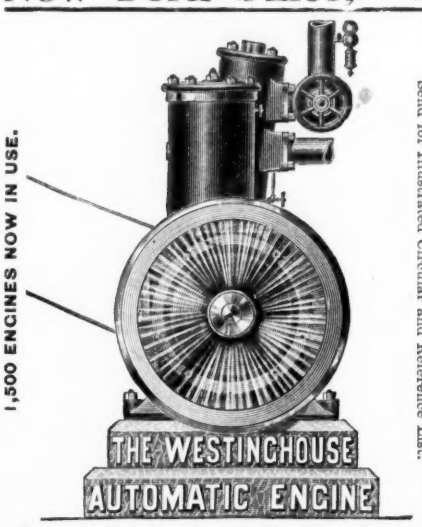

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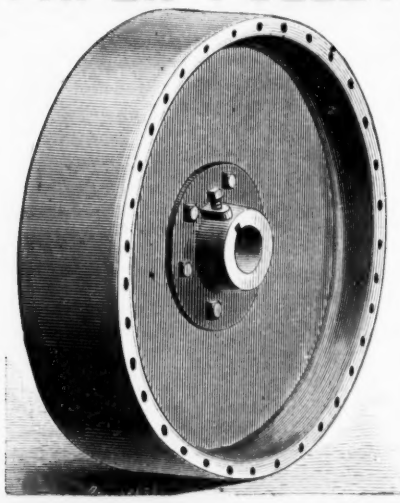

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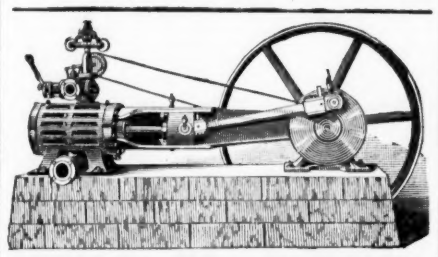

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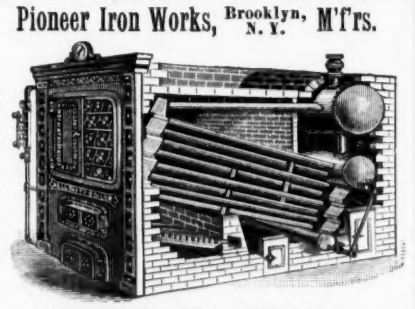

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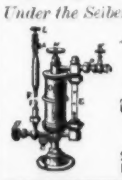

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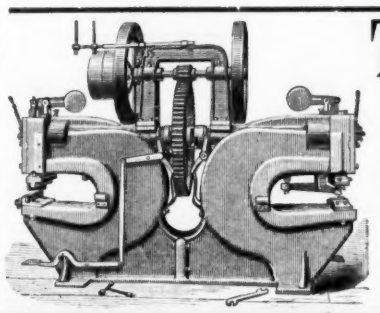

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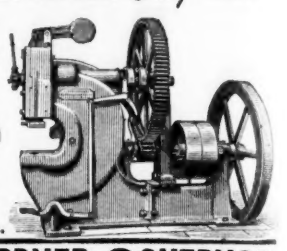

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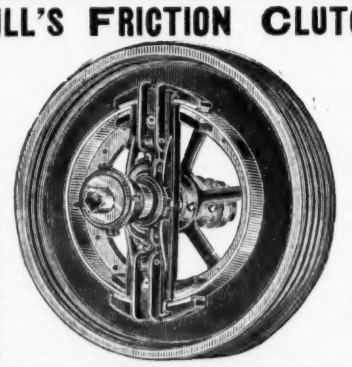

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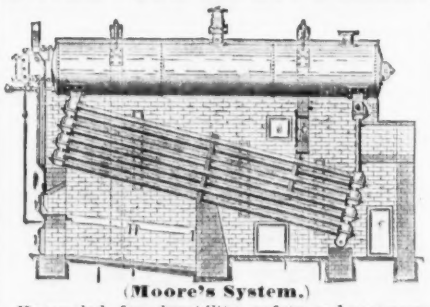

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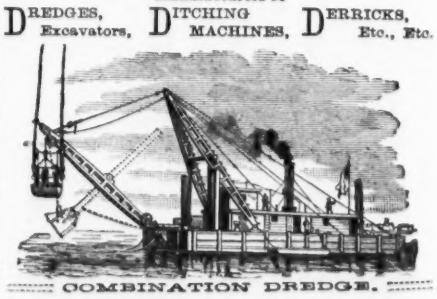

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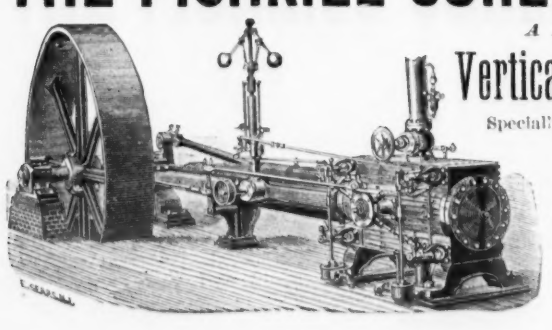

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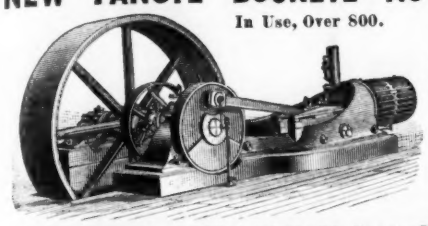

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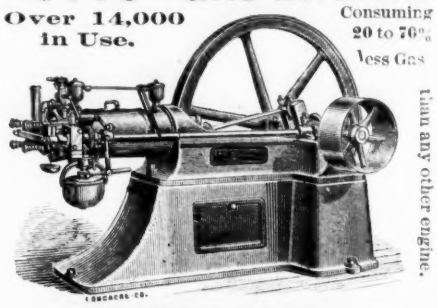

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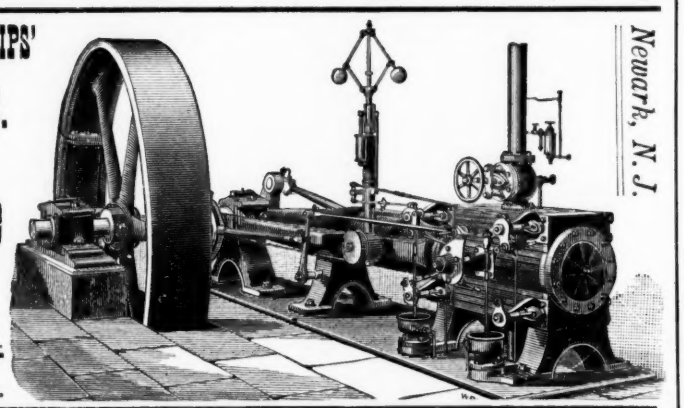

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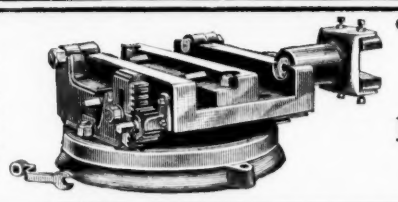

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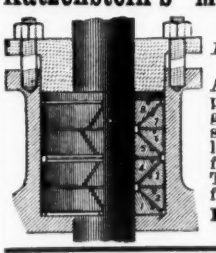

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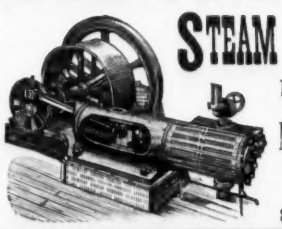

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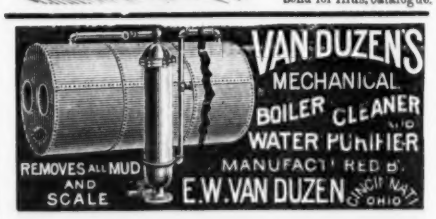

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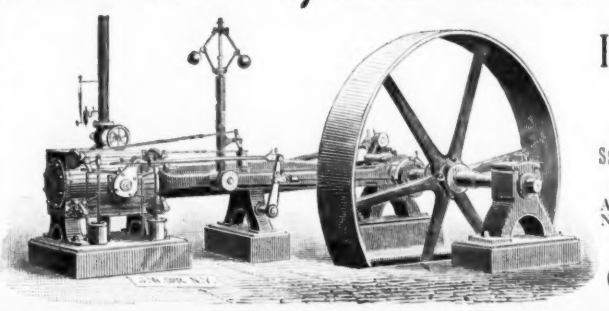

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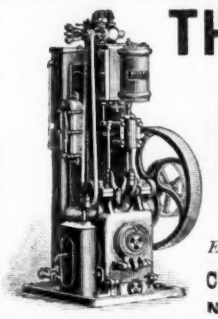

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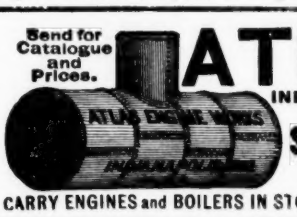

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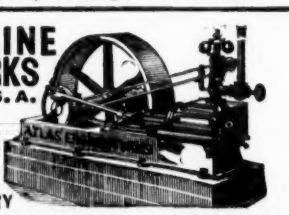

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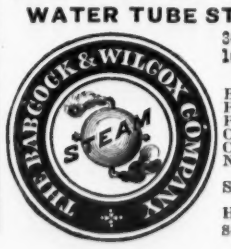

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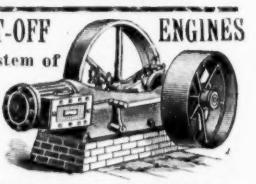

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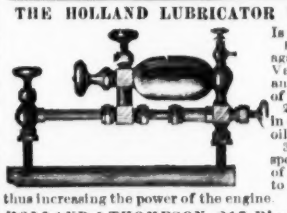

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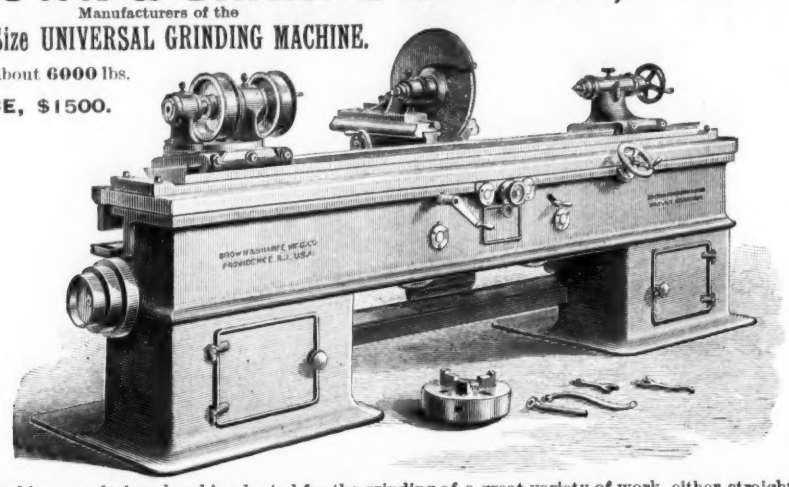
PRICE, $1500.



This Machine was designed and is adapted for the grinding of a great variety of work, either straight or taper, having a capacity to take work upon centers 14 inches diameter and 6 feet in length. The emery wheel, which is 18 inches diameter by 1 inch thick, is driven by two 1¾ inch belts. Overhead works accompany the Machine. Tight and loose pulleys 12 inch diameter, 4½ inch face. Speed of first counter 250 turns per minute. Boxed and delivered at railroad or steamboat in Providence.

CAR WHEEL AND AXLE MACHINERY.

RAILROAD, LOCOMOTIVE AND CAR SHOP

EQUIPMENTS

Photographs and Prices on application.

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Hamilton, Ohio.

PHILADELPHIA, 713 Chestnut St.
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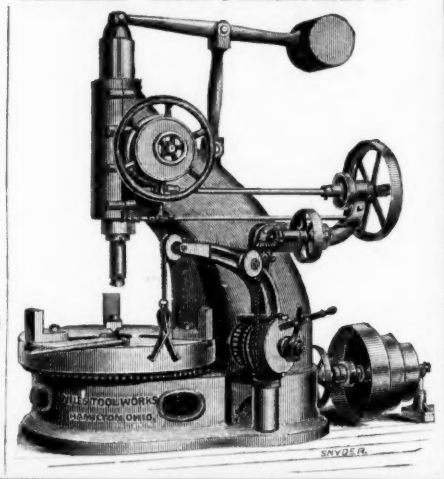

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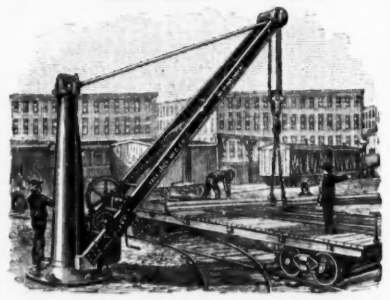
PILLAR CRANES,

ANY CAPACITY.

Load Always "Self-Sustained"



Specification and Tender promptly submitted on receipt of Capacity, Height of Hoist, and Effective Radius desired.

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General Crane Catalogues on Application.

NEW GRINDSTONE DRESSER

WILL DRESS A MACHINE-SHOP STONE IN FIVE MINUTES,

EITHER WET OR DRY! NO DUST!

WRITE FOR CIRCULARS.

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E. GOULD & EBERHARDT,

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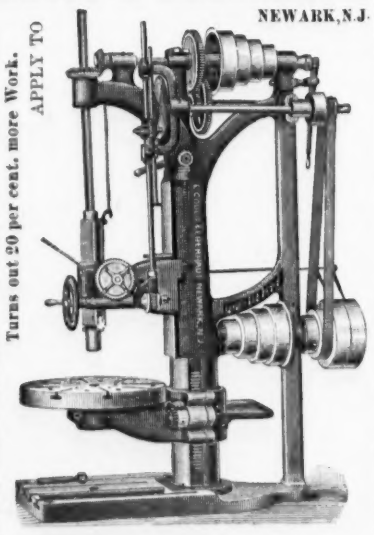
EBERHARDT'S NEW DRILL

Turns out 20 per cent. more Work.

APPLY TO



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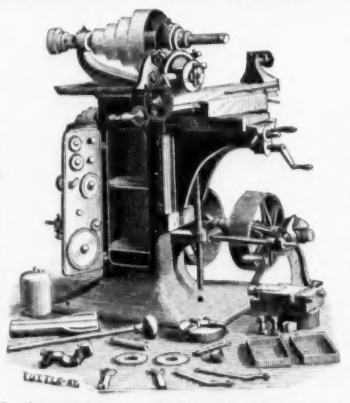

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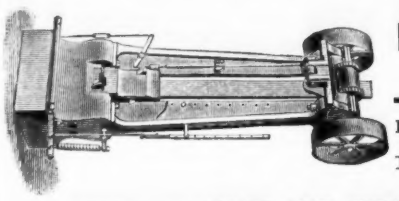

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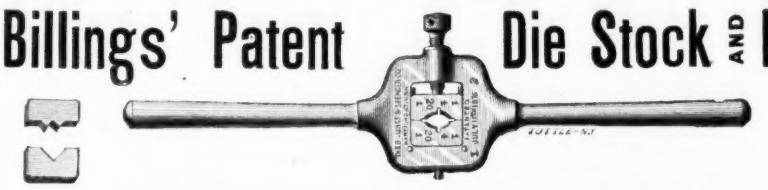
Billings' Patent  **Die Stock AND Dies.**

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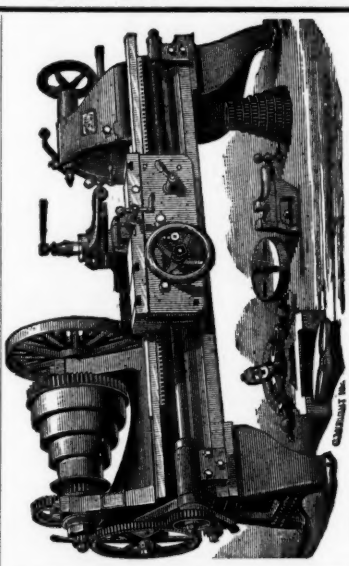

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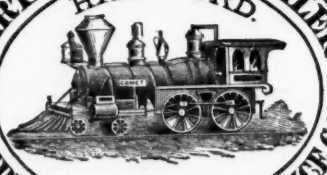

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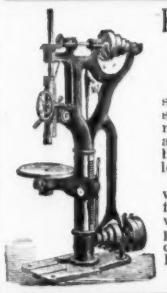

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20 in. Drills a specialty.

Our 20 in. Drill is a heavy substantial tool, made for service, has steel shafts and spindle. Gears and racks cut from the solid and have all modern improvements, are made by special machinery, and sold very low.

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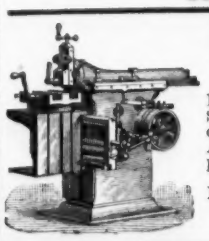

All the adjustments are made without operator moving from his position. It is made to act as a SLOTTING MACHINE, and is so arranged that KEY SEATS may be cut in any part of a shaft of any length, and from 4 inches in diameter down, and will plane a block 26"x26"x20". Has SWIVEL GRADUATED VISE, two changes of speed, and is geared 36 to 1. It is very heavy and powerful, and is guaranteed to give perfect satisfaction.

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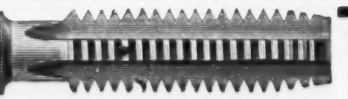

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